Implementing and Improving an Energy Management System

How to Meet the Requirements of ISO 50001

Graham Wooding and Kit Oung

bsi.

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Preface

ISO 50001:2011, *Energy management systems – requirements with guidance for use*

The title sounds impressive, but just what is ISO 50001? The fact that you have picked up this book indicates that you have an interest in managing the scarce resource that we know as energy as best as you possibly can. ISO 50001 sets out a framework within which you can do just that.

Many knowledgeable people have long understood that energy efficiency is as important to a sustainable future for mankind as is the work in researching and developing alternative forms of energy. It now seems clear that many of these alternative forms of energy – although scientifically feasible – will take time and a great deal of resource to bring to the market, and some of them are now seen to present environmental challenges that need to be dealt with.

So, making sure that we use energy – from whatever source – as efficiently but also as effectively as possible remains an overriding priority.

That is why ISO attaches such importance to ISO 50001. The good management of energy makes sense. Some of ISO's most well-known standards are management system standards (MSSs), standards that have proved to:

- make more efficient use of resources;
- improve the management of risk; and
- improve the likelihood that services and products consistently deliver what they promise.

MSSs are also firmly based on the principle of continual improvement. To quote from the MSSs page of the ISO website:

> An organization or company assesses its current situation, fixes objectives and develops policy, implements actions to meet these objectives and then measures the results. With this information the effectiveness of the policy, and the actions taken to achieve it, can be continually reviewed and improved.
>
> Source: www.iso.org/iso/home.htm

A recent survey showed that over 1.4 million certificates confirming the use of MSSs such as ISO 9001:2008, *Quality management systems – Requirements* have been issued in 178 countries. So the fact that ISO 50001 specifies the requirements for an energy management system (EnMS) based on the principles of all ISO MSSs is somewhat reassuring.

This certainly seems to be the view of an increasing number of governments and organizations, both large and small. For example, on 14 November 2012, the *Official Journal of the European Union* (Volume 55) published a new EU Directive: Directive 2012/27/EU on energy efficiency which amends Directives 2009/125/EC and 2010/30/EU and repeals Directives 2004/8/EC and 2006/32/EC.

This so-called Energy Efficiency Directive (EED) makes specific provision for EnMS standards and, in particular, those that have been 'adopted by the International Standardization Organization and made available to the public'. ISO 50001 is, of course, the prime example of such an international standard. We have used the ISO family of MSSs, and their predecessors, for over 20 years. We are both delighted to be able to apply some of this experience to help all those who want to use ISO 50001 as the framework for conserving our most precious thing, energy.

Several further international standards are being written by the same team of experts that developed ISO 50001. If their development progresses according to plan, they should be published in 2014 or 2015. The topics that these standards cover (and their ISO identifier) are as follows:

- ISO/DIS 50002, *Energy audits*
- ISO/CD 50003, *Energy management systems – Requirements for bodies providing audit and certification of energy management systems*
- ISO/CD 50004, *Energy management systems – Guidance for the implementation, maintenance and improvement of an energy management system*
- ISO/CD 50006, *Energy baseline and energy performance indicators (EnPIs) – General principles and guidance*
- ISO/CD 50015, *Monitoring, management, analysis and verification of organizational energy performance*

We hope to issue an updated edition of our book to encompass these new standards once they have been published.

A final thought, and then we can begin. Sometimes people think that implementing an MSS is difficult, that it involves a lot of documentation, and that it is expensive. This is simply not true. All that is required, and all that anybody should ever be tested on, is the application of common sense so that people (including you!) can understand what decisions were

taken and why they were taken, and can confirm the veracity of data. As you will learn later on, the size and complexity of your implementation of ISO 50001 is entirely up to you. If you choose to make it a large, complicated implementation, then unsurprisingly it is likely that it may be more expensive and create more documentation than if you choose to start with something rather smaller, succeed at that, and then decide to build on your success. We cannot emphasize this enough.

About the authors

Graham Wooding is a practising management consultant with over 30 years' experience in organizational leadership and in the management and implementation of business systems. He specializes in management as related to energy and energy efficiency and is obsessive about the importance of correct terminology.

Graham was previously a British Standards Institution expert and part of the international team that drafted ISO 50001.

Kit Oung is a practicing energy consultant specializing in energy and carbon reduction strategies using low-cost/high-return opportunities and EnMSs. He has 15 years' experience in energy auditing and implements energy reduction projects for blue chip multinational companies including petrochemical, specialty chemical, pharmaceutical, food and beverage and large commercial properties across five continents.

Kit is a British Standards Institution expert where he regularly reviews and provides input to various energy and environmental standards. He chairs two international standards committees in developing energy auditing standards and is the author of *Energy Management in Business: The Manager's Guide to Maximising and Sustaining Energy Reduction* published by Gower.

Introduction

First principles matter

Ask around and you will find that everybody has a different experience of implementing an ISO standard. Our view is that often people come unstuck because nobody has bothered to explain to them some of the basics about how ISO standards work. It is important that you do understand, because if you do not, then you have a great risk of blundering around in the trees not knowing what wood you are in.

This need to understand some fundamental principles is even more important in the case of energy. There are some fundamental technical or scientific principles that apply throughout the field of energetics. If you get to know how these fundamental principles apply in the context of a standard such as ISO 50001 before you start your implementation, then your chances of success are improved.

This book will be of help to those who have experience of management system standards (MSSs) but not of energy management, or vice versa. If you have experience of energy management, then this book should be sufficient as it stands to allow the implementation of ISO 50001. If you do not have experience of energy management but do have experience of implementing MSSs, then this book should be sufficient for you to understand what consultancy/experience in relation to energy you need to find in order to augment your experience with MSSs.

Part A – Understanding ISO standards

So, we make no apology for saying that the first part of this book concentrates on giving you some guidance on the use of these cross-cutting ISO subjects:

- The structure of ISO standards;
- Terminology;
- An overview of ISO 50001 (as an *amuse-bouche*);
- Conformity assessment;
- Attestation;
- Providing the evidence;
- Documentation;
- Implementation following the ISO 'process approach'.

Now, some of our readers will already have a good knowledge of all of these cross-cutting themes; if you do, then please go straight ahead to Part B of the book. Even so, and we know that we run the risk of being patronizing here, please dip in and out of Part A just to see whether some things there might be beneficial to you.

Part B – Understanding core technical principles

What, then, about the technical or scientific principles? Well, this book is about implementing an energy management system (EnMS), so we have no intention of delving into a deep technical discussion. However, we do need to establish a common understanding about some things, especially if you are reading this as an experienced implementer of MSSs, but are not so experienced in the world of energy management.

In Part B of the book, we cover:

- energy efficiency;
- energy performance;
- measurement.

Part C – Implementing ISO 50001

In Part C we will take you through ISO 50001 line by line, giving you some practical guidance on how to comply with the requirements of the standard. If you feel comfortable with your technical and/or scientific understanding, you can of course go straight to Part C of this book. However, we should warn you that Part C frequently cross-references Part B.

Preconditions

We hope that you enjoy this book; this has certainly been our aim when writing it. We have but two requests to ask of you. These are that you:

- are patient, and read the book thoroughly;
- have a copy of ISO 50001 to hand. Our book is an aid to the effective use of the standard that expands upon and gives practical approaches to meeting its requirements, not a replacement for it.

Part A – Understanding ISO standards

Chapter 1 – ISO standards

Introduction

ISO has a formalized process for preparing its standards, and those standards themselves have a prescribed structure. A key concept is that standards are always the result of consensus. What this means is that sometimes a standard may contain a concept that some experts do not agree with, but because a consensus of experts do agree, the concept remains in the standard concerned; we talk about this some more later on.

Standards writers are encouraged to write very short statements. ISO believes that such brevity should help the users of standards to understand better what is required. (It also makes translation somewhat easier.) However, such brevity can make it difficult to understand the rationale for the requirements, and that can make it difficult to implement the entire management system.

So if you are new to ISO standards – or if you have not implemented an ISO standard for some time – it is certainly worth your while getting to understand just how an ISO standard is drafted.

What is a standard?

Let us start with a short overview of the various types of ISO standard. Once we have done this, we can then put ISO 50001 into a meaningful context.

As good a place to start from as any is the ISO definition of what a standard is. Here it is:

> standard
> document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context
>
> NOTE Standards should be based on the consolidated results of science, technology and experience, and aimed at the promotion of optimum community benefits.
>
> Source: ISO Guide 2:2004, 3.2

Let us also take a look at the ISO definition of an international standard. Here it is:

> **international standard**
> standard that is adopted by an international standardizing/standards organization and made available to the public
>
> Source: ISO Guide 2:2004, 3.2.1.1

We would like to make some observations that arise from these two definitions:

- Note that the contents of any standard are established by consensus. This means that from time to time users of ISO standards might comment that standards are not as overwhelmingly 'best practice' as they had expected. Our view is that provided that ISO standards do achieve the 'optimum degree of order in a given context' (see the definition of a standard quoted above), then they can be beneficial in spreading best practice around the world.
- Note also that a standard should provide the framework for repeatability, and that such repeatability applies to individual activities, to the results of those activities, and to the operational control of those activities. We will see how important it is to understand this in the context of ISO 50001 a little bit later on.
- There is little doubt that ISO is an international standardizing organization. As people who care about the environment very much indeed, we think it is tremendous that we now have an international standard that helps spread best practice in how mankind manages energy.

Types of ISO standard

It is common for people to talk about ISO standards as if they were just one generic type of standard. This is not the case. ISO publishes a series of so-called 'guides', many of which are available for public download from the relevant ISO site. These guides provide guidance to technical committees for the preparation of standards, often on broad fields or topics.

One such guide, and one that it is worth downloading and taking a look at, is *ISO Guide 2*. We say it is worth taking a look at because, apart from anything else, it is the authoritative source of the terms and definitions associated with ISO standards. It can sometimes be handy to have this 'in the back of your pocket' when you are conducting conversations with external certification bodies.

ISO Guide 2 lists these types of standard: basic standard, terminology standard, testing standard, product standard, process standard, service standard, interface standard, standard on data to be provided.

ISO 50001 falls into the first type; it is a basic standard. Here is the definition of a basic standard, from *ISO Guide 2*:

> **basic standard**
> standard that has a wide-ranging coverage or contains general provisions for one particular field
>
> NOTE A basic standard may function as a standard for direct application or as a basis for other standards.
>
> Source: ISO Guide 2:2004, 5.1

Technical committees – the owners of ISO standards

ISO standards related to a particular technical field are normally drafted under the guidance of a technical committee (TC).

The TC responsible for ISO 50001 has already set out a roadmap for other standards that will build upon ISO 50001. This roadmap can be found by downloading the business plan for TC 242. Just go to the main ISO website and search for 'business plan'. This book stands alone in its own right, but it is certainly worth your while keeping an eye out for the next in the series of ISO 50001 standards as they get published.

TC 242 is not the only TC that is involved with standards related to energy. It is, though, the only TC (at the time of writing) that is specifically tasked with producing standards that are to do with the management of energy. The reason why the first standard produced by TC 242 was ISO 50001 was because ISO 50001 provides the essential framework into which most other standards related to energy can be slotted. It had to come first. It is also (again, at the time of writing) the only standard related to the management of energy where compliance with the standard can be formally certified; in other words, it meets the requirements of the ISO standards related to conformity assessment. We talk about this in more detail later on.

Another TC that is involved with standards related to energy is TC 257. This TC is responsible for preparing standards that relate to the quantification and subsequent aggregation of reductions in the consumption of energy. There is close formal and informal liaison between these two TCs, and it is possible that readers of this book will want to use the guidance that will be available in the form of standards from TC 257 when they become available. (At the time of writing,

probably in 2015. Details are available in the business plan for TC 257, which can be downloaded from the ISO website: go to the main ISO website and search for 'business plan'.)

ISO 50001 is part of a subset of basic standards that ISO calls management and leadership standards. These standards are the subject of the next section.

Management and leadership standards

ISO now calls standards that provide requirements or give guidance on good management practice 'management and leadership standards'. Most people, though, still refer to them as management system standards (MSSs).

A good way to think about MSSs is to regard them as a manifesto – a public commitment to manage an organization in a systematic way, and an agreement to carry out audits to check that those commitments are being met.

MSSs are among the best-known of ISO's offerings. They all share some common elements whose genes come from ISO 9000:2005 *Quality management systems – Fundamentals and vocabulary*. A common misconception about quality management is that it is about a subjective assessment of how 'good' something is. This is not what is meant within ISO, where quality is defined as:

> quality
> degree to which a set of inherent characteristics fulfils requirements
>
> Source: ISO 9000:2005, 3.1.1

This concept, which can be summarized as 'fitness for purpose', is the foundation for all the ISO MSSs.

There are now many MSSs in addition to ISO 9000. They are divided into those which can be used for certification, such as:

- ISO 9001 (*Quality management systems*);
- ISO 14001 (*Environmental management systems*);

and those that provide guidance, such as:

- ISO 26000 (*Social responsibility*);
- ISO 31000 (*Risk management*).

As we said previously (but it is worth repeating), ISO 50001 is a certifiable MSS, like ISO 9001 and ISO 14001.

Do not scuttle

It seems traditional to scuttle past the Introduction and Scope sections as fast as you can, hoping that you have not been noticed. We, too, tend to do the same thing: we glance through the Introduction, but deep down we just want to get on with it, which is why we are soon engrossed in Chapter 1. This is a shame, because the people who draft ISO standards have often spent many hours reaching consensus on what to put into their introductions or scopes and what to leave for later. In fact, they are really given very little choice in the matter, because ISO tells them what goes where.

Also, if you scuttle past the introductions, scopes and terms and definitions elements of an ISO standard, you will find that the implementation of the standard is much more difficult than is necessary. Believe us, we know because we have done it. There is no point in making life difficult for yourself. So we make no apology for spending some time highlighting for you some of the key things about ISO standards that we think you need to know.

(If you really want to understand the detail behind the drafting of an ISO standard, then you are best to go to the ISO website, search for 'directives', and look at the ISO/IEC Directives Parts 1 and 2.)

Classifying the content of ISO standards

Let us start with a couple of important concepts. The first is to understand that an ISO standard is what ISO itself calls a 'normative document'. Here is the ISO definition:

> **normative document**
> document that provides rules, guidelines or characteristics for activities or their results
>
> Source: ISO Guide 2:2004, 3.1

Note the use of the words 'activities or their results'; we will soon see that ISO 50001 does indeed cover both activities and the results.

What about 'rules, guidelines or characteristics?' Well, the thing to understand is that the contents of ISO standards are classified in two different ways. The first way is that they are divided into what ISO terms either 'normative' or 'informative' elements. Normative elements set out things that you must understand and comply with, whereas informative elements set out additional, hopefully helpful, information intended to assist the understanding or use of the document (or its relationship to other documents). Let us focus on normative elements. Here is the ISO definition for the term 'normative element':

normative element
element that describes the scope of the document or sets out provisions

Source: ISO/IEC Directives, Part 2

We will talk about the Scope, referred to on page 7, very shortly, but first we need to discuss the term 'provisions', because it is by understanding what these are that we can understand how ISO sets about issuing rules, guidelines or characteristics.

Provisions are so important that yet again we are going to set out the relevant ISO definition:

provision
expression in the content of a normative document, that takes the form of a statement, an instruction, a recommendation or a requirement

NOTE These types of provision are distinguished by the form of wording they employ; e.g. instructions are expressed in the imperative mood, recommendations by the use of the auxiliary 'should' and requirements by the use of the auxiliary 'shall'.

Source: ISO Guide 2:2004, 7.1

With these definitions under our belts, it is possible to relate provisions to rules, guidelines or characteristics; we have done this in Table 1 below.

Table 1: Provisions and their type

Term	Definition	Type of provision
requirement	provision that conveys criteria to be fulfilled	rule
exclusive requirement	requirement of a normative document that must necessarily be fulfilled in order to comply with that document	rule
optional requirement	requirement of a normative document that must be fulfilled in order to comply with a particular option permitted by that document	rule
instruction	provision that conveys an action to be performed	rule
recommendation	provision that conveys advice or guidance	guideline

Term	Definition	Type of provision
deemed-to-satisfy provision	provision that indicates one or more means of compliance with a requirement of a normative document	characteristic
statement	provision that conveys information	characteristic
descriptive provision	provision for fitness for purpose that concerns the characteristics of a product, process or service	characteristic
performance provision	provision for fitness for purpose that concerns the behaviour of a product, process or service in or related to use	characteristic

Source: All terms and definitions are from ISO Guide 2:2004

Now, the way that ISO indicates that some words are actually a provision, and the type of provision, is to use special words, normally at the beginning of a sentence. We have set out these words in Table 2 below. (ISO has not made this particularly easy, because you will note that it has introduced two new things: 'permission' and 'possibility and capability'.)

Table 2: Normal verbal forms of different types of provision

Term	Type of provision	Normal verbal form	Permitted alternative forms
requirement	rule	shall	is to, is required to, it is required that, has to, only [...] is permitted, it is necessary
	rule	shall not	is not allowed [permitted] [acceptable] [permissible], is required to be not, is required that [...] be not, is not to be
recommendation	guideline	should	it is recommended that, ought to
	guideline	should not	it is not recommended that, ought not to

Term	Type of provision	Normal verbal form	Permitted alternative forms
permission	characteristic	may	is permitted, is allowed, is permissible
	characteristic	need not	it is not required that, no [...] is required
possibility and capability	characteristic	can	be able to, there is a possibility of, it is possible to
	characteristic	cannot	be unable to, there is no possibility of, it is not possible to

The key messages to take on board about all of this are:

- When an ISO standard uses the word 'should', it does not mean that you have to do whatever follows the word 'should'.
- Then again, when an ISO standard uses the word 'shall', it does mean that you have to do whatever follows the word 'shall' – that is, if you want to be able to say that you have complied with the ISO standard in question.
- However, please remember that the TC responsible for drafting the standard will only have made recommendations (in other words, have included sentences that start with 'should') where it thinks that it would be good practice to follow the recommendation.

We will give you guidance on all of this as it relates to ISO 50001 when we take you through the standard clause by clause.

It seems a long time ago that we said that there were two ways of classifying the content of ISO standards. We have talked about one of them, and now we will cover the other. Thankfully it is nowhere near as complicated.

Anybody who has filled in an online form knows that there are certain fields that you have to fill in, and certain fields that you do not have to fill in. So it is with ISO standards. The ISO Directives give examples of some 14 sections that go together to make up an ISO standard. However, only three of these sections must be completed by a TC when it drafts a standard.

These are:

- the Title;

- the Foreword;
- the Scope.

Now this seems rather remarkable when you consider that not many people purchase an ISO standard just to read the Foreword or Title, and many people will scuttle past the Scope; instead they purchase an ISO standard so that they can implement the detailed requirements set out in the standard. We will look at these detailed requirements in Part C. However, it seems to us that if ISO make it compulsory for every TC to write a Title, Introduction and Scope then it is probably worthwhile taking a look at these sections.

Title
Although ISO does give detailed guidance on how to phrase the title of an ISO standard, we think that the title of ISO 50001 requires no further explanation from us.

Foreword
The Foreword of all ISO standards consists of a general part and a specific part. The general part uses boilerplate text to give information concerning ISO and international standards in general. The specific part is the responsibility of the TC concerned and is used to give information about significant changes from any previous editions of the standard, and to set the standard in an appropriate technical and organizational context. Well, if you take a look at the foreword to ISO 50001, you will find that currently there is only a general part; this is hardly surprising, because of the newness of ISO 50001.

Scope
You will remember that we have already given you some quotes from various ISO publications when we have felt that it is really important for you to understand what ISO is saying. This applies to the Scope element of ISO standards. Here is what ISO says:

> This element shall appear at the beginning of each document and define without ambiguity the subject of the document and the aspects covered, thereby indicating the limits of applicability of the document or particular parts of it. It shall not contain requirements.
>
> Source: ISO/IEC Directives, Part 2:2011, 6.2.1

Now why is this important? Please read through the quote again. It will become clear to you that everything else in any ISO standard comes from the Scope.

Scope statements are not there to trip you up, but they can if you do not take time to read and understand them. If you have read and understood the Scope then you will be a long way toward a successful implementation. You will know what the standard covers and therefore

which areas to focus on. You will avoid wasting time on things that are unimportant. If you can demonstrate a good understanding of the Scope to anyone performing conformity assessment this will also stand you in good stead.

We will demonstrate the importance of the Scope with respect to ISO 50001 in Part C. Make sure to read it!

Chapter 2 – Terminology

Introduction

In conversation, you sometimes hear two English speakers use the phrase 'Now you're talking my language.' What a strange thing to say when it is quite clear that they both talk the same language: English.

Of course, what they are really saying is: 'Now your intended meaning of the words that you are using and my understanding of those words is the same.' This is not strange at all. In fact, it is the basis of any form of communication that has robust meaning, because it means that each participant is using words in the same way and with the same meaning.

This chapter may be a relatively short chapter, but it is probably the most important. If you do not take care to ensure that your understanding of something is the same as somebody else's, then you will not be talking the same language.

Special languages

There is a difference between a general and a special language.

A general language is one that everybody uses to communicate with each other. The meaning of the words in everyday use can be found by using a general dictionary such as the *Oxford English Dictionary*.

In contrast, a special language is one that a specialist in a particular technical field uses to communicate with other specialists. This means that the resources used to document special languages are structurally differently from traditional lexicographical dictionaries. Examples of such specialist resources are the subject-specific Oxford dictionaries, and all the specialist vocabularies published by ISO. For example, you can find vocabularies for technical fields such as cranes, fluid power systems, petroleum, reciprocal internal combustion engines, and so on.

Now, what you need to understand is that, when words are being used as part of a special language, these words are normally called 'terms'. This is the sense and the term that ISO uses. Is this important? Yes it absolutely is, and please let us explain why.

The importance of terms and definitions

The writers of ISO standards are encouraged to be as brief and succinct as they possibly can. This means that every word that is written is full of meaning. If that word is a term, then it is really important that you understand exactly what is meant. The way to understand what the words mean is to study and learn that part of most ISO standards that is titled 'Terms and definitions'.

The proper use of terms is so important that one of the quality checks carried out on ISO standards is to apply the 'rule of substitution'. This rule says that you should be able to find any term in an ISO standard and replace that term with the definition, such that the sentence still makes sense.

If you are ever unsure what a sentence really means, check whether any of the words in the sentence are terms (in other words, whether they are defined in the terms and definitions clause), and if they are, then apply the rule of substitution.

Example 1 Let us give you an example. In general language, the word 'use' has many different definitions. Here are just three:

- To consume;
- To put to practical or effective use; or
- To utilize.

Because you are reading this book, you will have a good understanding of energetics. Therefore, you will understand that only two of these general definitions properly apply to us.[1]

Example 2 Let us give you another example of why reading through and understanding terms and definitions is so important. Later on in this book we look at documentation. It is possible (and indeed we shall do this) to count up the number of documents that ISO 50001 requires – in other words, the documents that you must be able to show to anybody who is checking whether you comply with the requirements of ISO 50001. If you have not read the terms and definitions, then you will make a mistake. Why? Because the definition of the term 'internal audit' is:

> **internal audit**
> systematic, independent and documented process for obtaining evidence and evaluating it objectively in order to determine the extent to which requirements are fulfilled
>
> Source: ISO 50001:2011, 3.20

[1] The law of conservation of energy indicates that you cannot 'consume' energy!

Note the word 'documented'. The requirement that an internal audit be documented is not mentioned anywhere else in the standard, but you can be sure that anybody who is checking compliance will know that it has to be.

The use of specific terms can be a nightmare. To help you, we will highlight any problematic terms as we go through Part C. We have also reproduced for you the 'Terms and definitions' section from ISO 50001, in Appendix A. (By the way, you can get free access to almost every term that has been defined in an ISO standard by going to the ISO website, searching for 'concept database', and following the link.)

Common words used in the ISO 9000 series of standards

We have not finished yet. While we are stamping our feet about terminology, we also need to explain that ISO has a kind of halfway house between words and terms. What do we mean? ISO publishes a list of common words that are used in the ISO 9000 series of standards. This list is available from the ISO website, but for your convenience we have reproduced it in Appendix B.

Chapter 3 – A bird's eye view of ISO 50001

Introduction

We saw in Chapter 1 that all management system standards (MSSs) such as ISO 50001 share some common elements based on the fundamentals set out in ISO 9000. Also, we saw that every MSS has both common elements and elements that are specifically tailored for the sector concerned. Finally, we saw that both the common and the sectoral elements represent a consensus view of what ISO terms the 'state of the art'.

Why are we making such a point of this? There are two reasons. The first is because ISO 50001 represents the 'state of the art' (or at least as complete a statement of the state of the art as has been agreed by consensus) on how to provide a framework for managing energy by use of an energy management system (EnMS).

The second reason is because when you decide to implement ISO 50001, you are making a public commitment to adopt a practice that is state of the art in relation to energy management. (This is one reason why governments have supported ISO 50001 so strongly.)

The ISO 50001 manifesto

Let us now discuss what the ISO 50001 manifesto is. The headline commitment is this:

> ... to follow a systematic approach in achieving continual improvement of energy performance, including energy efficiency, energy use and consumption.
>
> ISO 50001:2011, Scope

Please remember this quote; it is the ultimate yardstick by which your implementation will be judged. We talk about this in more detail later on; right now, though, let us take a bird's-eye look at the requirements of ISO 50001. We have divided the requirements into the common and the sectoral elements that we discussed earlier.

Common MSS commitments

Here is a summary of the major requirements of those elements of ISO 50001 that are common to all MSSs:

- Agree, document and declare the organization's policy in respect of the area addressed by the MSS.
- Express this policy in the form of strategic and tactical objectives.
- Publish procedures and work instructions (as necessary) to implement policy (in this case energy policy).
- Demonstrate top management sponsorship by leadership and by the allocation of sufficient and appropriate resources (including persons of appropriate competence).
- Communicate widely both within and outside the organization. In the case of ISO 50001, communication would be in regard to energy policy and energy performance.
- Regularly audit the performance of the MSS, and implement action plans to deal with non-conformance or to realize opportunities for improvement (in essence, to adopt an approach of continuous improvement).

Sectoral commitments

Here is a summary of the major requirements contained in the sectoral elements of ISO 50001:

- Review, document and comply with legal and other regulations, and iterate this process at regular intervals.
- Carry out reviews in order to map the use of energy within the organization.
- Use the results of energy reviews so as to create an initial and regularly updated baseline case, incorporating adjustments to variables and period normalization as necessary.
- Plan and implement the use of energy performance indicators (EnPIs) so as to continually monitor energy performance.
- Use the energy review(s) to identify opportunities for significant improvement in energy performance.
- Plan and action plans to deal with non-conformance or to realize opportunities for improvement in energy performance.
- Use appropriate measurement, analytical and verification techniques to verify improvement in energy performance.
- Include energy performance in the criteria for: (a) product and/or service design; (b) procurement; and (c) sub-contractual arrangements.
- Adhere to the principles of continuous improvement (as often expressed by the 'Plan, Do, Check, Act' (PDCA) cycle based on the work of Shewhart and Deming) in the monitoring, analysis and review of the EnMS.

- Encapsulate these energy commitments (and the common requirements, where necessary) in a published energy policy. (This requirement is true of all MSSs, but is included here because of its importance to improving energy performance.)

Chapter 4 – Conformity assessment

Introduction

Normally, when you implement a management system standard (MSS) such as ISO 50001, you also want to prove – to yourself, your organization, or to a third party – that your implementation has been successful. ISO has a particular term for this, which is:

> **conformity assessment**
> demonstration that specified requirements relating to a product, process, system, person or body are fulfilled
>
> Source: ISO/IEC 17000:2004, 2.1

It makes sense, therefore, that if one of your goals is to be able to prove conformity, then an understanding of how ISO views conformity assessment will be very important for you. It really does not matter what you think about the subject, it is what ISO says that matters. This is especially true if you intend to ask somebody outside of the organization to attest to the fact that your implementation of a standard such as ISO 9001 does fulfil requirements.

You may remember that in Chapter 1 we said that ISO standards related to a particular technical field are normally drafted under the guidance of a technical committee (TC). Conformity assessment applies to every technical field, which is why ISO does not use a TC to produce standards related to conformity assessment. Instead, there is 'The ISO Committee on Conformity Assessment' (CASCO).

CASCO has published 27 standards to date. Clearly not all of these are relevant to you and to your implementation of ISO 50001 (*Energy management systems).* However, some definitely are relevant – and especially the two listed below:

- ISO/IEC 17000:2004, *Conformity assessment – Vocabulary and general principles.*
- ISO/IEC 17021:2011, *Conformity assessment – requirements for bodies providing audit and certification of management systems.*

We have tried to highlight in this chapter some of the most important issues contained in the first of these standards, and we deal with the second one in the next chapter. This means that you do not have to

obtain the standards in order to have a successful implementation of ISO 50001. But remember that they are available if you ever want to read the first principles of conformity assessment.

Conformity assessment

Where to start? Well, perhaps a good place is to take a look in more detail, to decompose if you like, the ISO definition of conformity assessment.

The importance of scope

Remember that a characteristic of all ISO MSSs is that you have to define the scope of implementation for the standard. This is important, because conformity assessment applies only to the scope that you have decided upon. Therefore, it is important to think long and hard about the scope of your implementation before you start. We talk about this in more detail in Part C of the book.

Boundaries

Please do not confuse scope and boundaries. All MSSs require a written declaration of scope. ISO 50001 goes beyond this because it also requires you to define boundaries. Why is this? The answer is that the energy management system (EnMS) described by ISO 50001 involves measurement. For example, establishing energy efficiency involves measuring 'an output of performance, service, goods or energy, and an input of energy'. But just what output and input are we talking about here? Or, put in other words, what are the limits of this measurement? This is where the term 'boundary' is used:

> boundaries
> physical or site limits and/or organizational limits as defined by the organization
>
> EXAMPLE A process; a group of processes; a site; an entire organization; multiple sites under the control of an organization.
>
> Source: ISO 50001:2011, 3.1

The implication is that there can be multiple boundaries specified within the overall scope of an ISO 50001 implementation. This is indeed the case, as is clarified here:

scope
extent of activities, facilities and decisions that the organization addresses through an EnMS, which can include several boundaries

Source: ISO 50001:2011, 3.26

It can seem confusing, so we give you a few examples in Table 3.

Table 3: Examples of scope and boundaries

Scope		Boundaries	Explanatory notes
Type	Example		
Activity	Heating	Building number 01 Building number 03	There is also a building number 02, but it is not part of the scope.
Activity	Heat generation	Boiler number 01 Boiler number 03	There is also a boiler number 02, but it is not part of the scope.
Facility	Energy use	All facilities in Europe	There are also facilities in other regions, but these are not part of the scope.
Facility	Incinerators	Incinerator number 01 Incinerator number 03	There is also an incinerator number 02, but it is not part of the scope.
Decisions	Choice of fuel	For the space heating of office accommodation	Space heating is also provided for engineering workshops, but is not part of the scope.
Decisions	Choice of fuel supplier	All facilities in Europe	Be careful to make sure that you specify exactly what you mean by the term 'fuel'.

'Shalls' and 'shoulds' – reprise

Within ISO, the concept of 'conformity assessment' is to do with the 'fulfilment of specified requirements' and not to do with the wider concept of 'conformity'. Remember this. Remember that you will be asked to demonstrate conformity with the requirements that have been specified in ISO 50001. You will not be required to demonstrate that any of the recommendations in ISO 50001 – or indeed any other ISO standard – are fulfilled. If you are unsure about the difference between a requirement and a recommendation, then this is covered in Chapter 1; a good rule of thumb is to remember that where any standard uses the term 'shall', then that indicates a requirement, whereas the term 'should' indicates a recommendation.

Please do not misunderstand us. As members of several ISO TCs, we can say that every recommendation is there for a purpose. There is no doubt in our minds that any organization that is able to demonstrate fulfilment of both requirements and recommendations is likely to have an excellent management system – in this case, an excellent EnMS. However, you do not need to demonstrate fulfilment of both requirements and recommendations in order to attest that you are ISO 50001 certified.

It is important that you decide right at the beginning of your implementation project whether your goal is to satisfy just the minimum requirements – the 'shalls' – or both the 'shalls' and 'shoulds'. Take care though when you make this decision, because there may be other reasons why you should satisfy the 'shoulds' as well as the 'shalls'. For example, you may find that external entities (such as a government agency or public programme) stipulates that you must comply with the 'shoulds' in order to meet the criteria for various forms of incentives.

Continuous assessment and continuous improvement

Remember that conformity assessment is not something that you do just once and then forget about. Far from it, conformity assessment is the basis for continuous improvement.

1. Carefully decide the scope of your implementation.
2. Equally carefully decide the requirements with which you aim to demonstrate conformity.
3. Document those requirements in the form of a specification.

By following the steps above, you lay down the basic framework within which performance can be assessed. Within this framework, nonconformity is identified, corrective actions taken, and continuous improvement achieved.

Objects

Something else that we need to bring to your attention is this phrase taken from the definition of conformity assessment: 'relating to a product, process, system, person or body'. Why is this important? Well the 'Terms and definitions' clause of any standard often includes notes. It is important that you read these notes.

For example, here are the two notes that follow the definition of conformity assessment:

> NOTE 1 The subject field of conformity assessment includes activities defined elsewhere in this International Standard, such as testing, inspection and certification, as well as the accreditation of conformity assessment bodies.
>
> NOTE 2 The expression 'object of conformity assessment' or 'object' is used in this International Standard to encompass any particular material, product, installation, process, system, person or body to which conformity assessment is applied. A service is covered by the definition of a product.
>
> Source: ISO 17000:2004, 2.1

To be slightly contrary, we are going to discuss the second note first! The point that we want to make is that – in accordance with Note 2 – we are going to use the expression 'object of conformity assessment' to denote any requirement of ISO 50001 where conformity assessment will be applied.

Now we need to discuss Note 1. The point to be made here is simply that ISO 50001 does indeed have activities – such as auditing, reviewing, setting baselines, measuring, verifying, and so on – all of which are objects of conformity assessment.

Understanding 'specified requirements'

We need to talk about one more thing regarding conformity assessment, and then we can move on to discussing how you can provide evidence of conformity assessment. What does 'specified requirement' mean? Here is the ISO definition:

> **specified requirement**
> need or expectation that is stated
>
> NOTE Specified requirements may be stated in normative documents such as regulations, standards and technical specifications.
>
> Source: ISO/IEC 17000:2004, 3.1

In our experience, the best way to explicitly state either a need or an expectation is to write it down. A specification can take many forms. It may be a statement of work, or a procedure, or a checklist that must be completed.

Sometimes people who are new to the world of ISO standardization get quite frightened about what seems to be such a structured system. They might feel that structure requires formality. This is a great shame, because the authors of standards completely understand that six organizations – or entities – within a 200-metre radius of each other are more than likely to be completely different in terms of size, maturity and purpose. If you extend that radius to a kilometre, then to a town or city, then to a country, then to the world, it takes no time at all to realize that although the fundamental principles of conformity assessment never vary, ISO understands that the formality with which conformity is demonstrated will vary a great deal, and this is okay!

The fact that ISO understands that the formality of assessment of conformity may vary is especially true with regard to the evidence that you will be expected to produce to prove conformity. Remember that this proof can be to yourself, to your organization, or to an external organization. And please do not be concerned about the word 'evidence'; we will show you in the next chapter that an object of conformity assessment such as 'an energy review' that sounds technical can be proved to be fulfilled by something as simple as a single piece of paper on which you have listed the energy that you use in your single-room office or workshop.

Chapter 5 – Attestation (or how to say that you comply)

Introduction

You may recall that in Chapter 1 we said:

> There are now many MSSs in addition to ISO 9001. They are divided into those which can be used for certification, such as:
>
> - ISO 9001 (*Quality management systems*);
> - ISO 14001 (*Environmental management systems*);
>
> and those that provide guidance, such as:
>
> - ISO 26000 (*Social responsibility*);
> - ISO 31000 (*Risk management*).
>
> As we said previously (but it is worth repeating), ISO 50001 is a certifiable MSS, like ISO 9001 and ISO 14001.

Now is the right time to explain in more detail exactly what this concept of 'certifiable' means. It is really important that you understand this before you set off on your implementation of ISO 50001. That said, if you are sure that you understand attestation, please feel free to skip this chapter. However, if you are new to the implementation of ISO standards, we recommend that you read it.

What is 'attestation'?

The majority of organizations that implement ISO 50001 want to tell other organizations that they have done so. What those external organizations want to know is whether the implementation complies with the requirements of ISO 50001. It is one thing to say that you have done something, but another thing altogether to publicly declare that you have done so in a particular way. This is at the heart of the concept of 'attestation'.

The *Shorter Oxford English Dictionary* definition of attest is: 'testify, certify formally'. ISO expands on this basic concept to suit the needs of conformity assessment:

attestation
issue of a statement, based on a decision following review, that fulfilment of specified requirements has been demonstrated

NOTE 1 The resulting statement, referred to in this International Standard as a 'statement of conformity', conveys the assurance that the specified requirements have been fulfilled. Such an assurance does not, of itself, afford contractual or other legal guarantees.

Source: ISO/IEC 17000:2004, 5.2

An important thing to note here is that nowhere in this ISO definition does the term 'certification' appear. This makes sense, because the dictionary definition allows for 'testify' and 'certify formally'. ISO deals with this by going on to define the three different ways in which the 'decision following review' (see the definition above) can take place.

Unsurprisingly, ISO also provides a detailed definition of what it means by 'review'. But for our purposes, it is probably best to regard a review as being an 'activity'. We say this because this allows us to explain the three types of what ISO terms 'conformity assessment activity'. So here we go:

first-party conformity assessment activity
conformity assessment activity that is performed by the person or organization that provides the object

NOTE The first-, second- and third-party descriptors used to characterize conformity assessment activities with respect to a given object are not to be confused with the legal identification of the relevant parties to a contract.

second-party conformity assessment activity
conformity assessment activity that is performed by a person or organization that has a user interest in the object

NOTE 1 Persons or organizations performing second-party conformity assessment activities include, for example, purchasers or users of products, or potential customers seeking to rely on a supplier's management system, or organizations representing those interests.

third-party conformity assessment activity
conformity assessment activity that is performed by a person or body that is independent of the person or organization that provides the object, and of user interests in that object

Source: ISO/IEC 17000:2004, 2.2 and 2.3

Certifying bodies

Sometimes people are confused about the difference between certification and registration. So to help clear up any confusion, let us say that there is no difference whatsoever between the two. They both describe a 'third-party conformity assessment activity' that is carried out by a 'conformity assessment body'. It just so happens that some people

like to describe these conformity assessment bodies as 'certifiers' who issue a certificate, and others like to describe them as 'registrars' who provide registration.

Also, do not confuse accreditation with certification. Accreditation is when a certifying body itself becomes authorized to carry out third-party conformity assessment activities.

What about 'audits'?

The phrase 'conformity assessment activity' is a bit of a mouthful, and you are probably more used to the term 'audit'. Yet again, ISO conveniently provides a definition of what it means by audit in the context of conformity assessment:

> **audit**
> systematic, independent, documented process for obtaining records, statements of fact or other relevant information and assessing them objectively to determine the extent to which specified requirements are fulfilled
>
> Source: ISO/IEC 17000:2004, 4.4

Your choice

So now we are able to set out the various ways in which you can say 'we have implemented ISO 50001'.

You can attest your conformity by means of a declaration after carrying out a 'first-party conformity assessment activity', perhaps more commonly known as 'self-assessment'. So you can simply say 'I declare that my organization complies with ISO 50001'.

Alternatively, you can attest your conformity by obtaining a certificate of conformity following a 'third-party conformity assessment activity', perhaps more commonly known as 'undergoing certification'.

Where then does a 'second-party conformity assessment activity' fit? Well, suppose that you have declared conformity with ISO 50001. In other words you have carried out a self-assessment. However, a 'second party' (such as a prospective customer or an external organization which has the power to afford you special privileges on the basis that you have implemented ISO 50001) wants to be assured that you have carried out the implementation correctly. Then this second party is likely to initiate a 'conformity assessment activity'; of course they might ask for this to be carried out by a conformity assessment body.

Conveniently, ISO assigns a particular term to a first-party and a third-party conformity assessment activity. Here are both terms:

> **declaration**
> first-party attestation
>
> **certification**
> third-party attestation related to products, processes, systems or persons
>
> NOTE 1 Certification of a management system is sometimes also called registration.
>
> NOTE 2 Certification is applicable to all objects of conformity assessment except for conformity assessment bodies themselves, to which accreditation is applicable.
>
> Source: ISO/IEC 17000:2004, 5.4 and 5.5

Which is best?

Well, it depends. It is not always immediately obvious at the start of the implementation of any management system standard (MSS) whether you will ever be subject to a third-party conformity assessment. But it can be dangerous to therefore assume that you need only carry out your implementation with sufficient rigour to later carry out a self-assessment and no more.

For example, it may be that the key to unlock various external benefits such as grants, access to markets, and so on is your acceptance of a third-party conformity assessment carried out on behalf of a second party. (Yes, we know that it gets confusing.) If you are certain that this will never happen, then the self-assessment route should be fine. However, if you think there is any chance of a third-party conformity assessment, then implement your system as if this will happen.

Our experience is that it is always best to plan your implementation so that it is fit for a third-party assessment. As the relevant ISO standard says:

> Certification of a management system provides independent demonstration that the management system of the organization:
>
> a) conforms to specified requirements,
> b) is capable of consistently achieving its stated policy and objectives, and
> c) is effectively implemented.
>
> Conformity assessment such as certification of a management system thereby provides value to the organization, its customers and interested parties.
>
> Source: ISO/IEC 17021:2011, Introduction

What does ISO 50001 say about attestation?

So what does this all mean in terms of ISO 50001? Here is what the scope clause for ISO 50001 says:

> This International Standard is applicable to any organization wishing to ensure that it conforms to its stated energy policy and wishing to demonstrate this to others, such conformity being confirmed either by means of self-evaluation and self-declaration of conformity, or by certification of the energy management system by an external organization.
>
> Source: ISO 50001:2011, Scope

This sentence is talking about attestation in the context of the particular standard designated ISO 50001. Because we now have greater understanding of what attestation is, we can put the alternatives open to you in the form of a simple table – Table 4, below.

Table 4: Conformity assessment – the alternatives

Type of conformity assessment activity	Initiated by	Carried out by	Resulting in a	ISO 50001
First-party	You	You	Declaration	Self-evaluation
Second-party	Not you!	You or much more likely a conformity assessment body	Declaration or certificate	Self-evaluation or certification
Third-party	You	A conformity assessment body	Certificate	Certification

Now we need to consider how to provide the evidence that the review – whether carried out by a first, second, or third party – will need in order to confirm that specified requirements have been fulfilled. This is the subject of the next chapter.

Chapter 6 – Providing the evidence

Introduction

We hope that by now you have a good idea about how ISO works, about how ISO 50001 fits within the overall suite of ISO management system standards (MSSs), and the importance of conformity assessment. If you do not, then we have already failed!

Now we need to explain what evidence you should accumulate and thus be able to provide in order to make any form of attestation.

Evidence requires more than documentation

At the beginning of this book we used the words 'do not scuttle'. We said this because we wanted to highlight that although you may be tempted to focus *solely* on the detailed requirements set out in what is normally Clause 4 of an MSS, it would be unwise to do so. Understanding the Scope of the standard is as important as understanding the detailed requirements.

This is because it is in the Scope that the overall aim of the standard is set out. It does not matter how much hard evidence you are able to produce, if you cannot also show that the aim of the standard has been achieved, then it is unlikely that you can attest compliance. We use the phrase 'hard evidence' to signal the fact that there is also 'soft evidence' such as evidence that the aim of the standard has been embedded in the corporate brain, or the psyche, or the culture, of the organization concerned.

What will auditors look for?

So, how do you know what evidence to keep? Well, as good a way as any is to get into the mind of an auditor who may be asked to carry out

a third-party conformity assessment. Such auditors will be very familiar with the ISO standard that sets out what ISO expects of auditors: ISO/IEC 17021.[2]

Here is a pertinent extract from the standard:

> 9.1.9.5 Collecting and verifying information
> 9.1.9.5.1 During the audit, information relevant to the audit objectives, scope and criteria (including information relating to interfaces between functions, activities and processes) shall be collected by appropriate sampling and verified to become audit evidence.
>
> Source: ISO/IEC 17021:2011

What are the lessons to be learned from this extract?

Well we said earlier that the writers of ISO standards are encouraged to make their sentences as concise as possible. Sometimes this conciseness can get in the way of understanding, and this is probably a case in point. It is important to note that there are *two* distinct processes: collecting information is the first, and verifying it is the second. Only once both these processes have taken place is 'audit evidence' produced.

Audit objectives, scope and criteria

The first process is to collect information, but what information? Well it is certainly not every piece of information about your organization; it is only a subset. Take note of these words: 'information relevant to the audit objectives, scope and criteria'. Now we have talked about scope before (see Chapter 1), but the scope referred to in respect of conformity assessment is different. It is time for another extract:

> 9.1.2.2 Determining audit objectives, scope and criteria
> 9.1.2.2.1 The audit objectives shall be determined by the certification body. The audit scope and criteria, including any changes, shall be established by the certification body after discussion with the client.
>
> Source: ISO/IEC 17021:2011

What do you need to be aware of here? Firstly, that an audit has objectives, scope and criteria. Each of these is different, as we will see in a minute. Secondly, an audit's objectives are *determined* by the certification body that is providing the auditor, but an audit's scope and criteria are *established* after discussion with you.

[2] This is a generic standard that applies to all MSSs. An equivalent standard specifically for ISO 50001 is being prepared by TC 242. It is unlikely that the generic guidance in our book will be much affected by this new standard, but if it is we will let you know through the BSI website.

Objectives

What does ISO have to say about an audit's objectives? An effective way of bringing your attention to some of the key things that we think you need to be aware of is by means of a simple table. So here, in Table 5, is our advice concerning an audit's objectives.

Table 5: Audit objectives

The ISO/IEC 17021 requirements	Our advice
9.1.2.2.2 The audit objectives shall describe what is to be accomplished by the audit and shall include the following:	Although the certification body might say that it is its job to determine the objectives of an audit, do not be afraid to have a robust conversation with it about the objectives. Make sure that you have seen the objectives before the audit starts.
a) determination of the conformity of the client's management system, or parts of it, with audit criteria;	Do make sure that you understand what the audit criteria are going to be. Also note the confirmation that an audit can be focused on specific parts of an overall management system.
b) evaluation of the ability of the management system to ensure the client organization meets applicable statutory, regulatory and contractual requirements;	Pay particular attention to this. As we will see in Part C, there is a requirement in ISO 50001[3] to understand 'applicable statutory, regulatory and contractual requirements'. Of course, there can be disagreement about what is 'applicable'. Our advice is to always write down the reasons why you think the 'statutory, regulatory and contractual' requirements that you choose are applicable to you – and be prepared to defend your case!
NOTE A management system certification audit is not a legal compliance audit.	This may be the case, but it is also the case that sometimes compliance with a standard such as ISO 50001 is a prerequisite for other things.
c) evaluation of the effectiveness of the management system to ensure the client organization is continually meeting its specified objectives;	Now this really is one to take note of. If you read the words carefully, you will understand that what is being looked for is evidence that you have

[3] ISO 50001, Clause 4.4.2 Legal requirements and other requirements: 'The organization shall identify, implement, and have access to the applicable legal requirements and other requirements to which the organization subscribes related to its energy use, consumption and efficiency.'

The ISO/IEC 17021 requirements	Our advice
	put your system in place in such a way that it is organically capable of sustaining continuous improvement in energy performance. It is not enough to be able to satisfy a checklist. You have to show how you are able continually to improve your energy performance.
d) as applicable, identification of areas for potential improvement of the management system.	Bear in mind that this is identification of areas for potential improvement in your implementation of ISO 50001, and not for potential improvement in your energy performance; we have already dealt with that above.

Scope

This is what ISO/IEC 17021 says about scope:

> The audit scope shall describe the extent and boundaries of the audit, such as physical locations, organizational units, activities and processes to be audited. Where the initial or re-certification process consists of more than one audit (e.g. covering different locations), the scope of an individual audit may not cover the full certification scope, but the totality of audits shall be consistent with the scope in the certification document.
>
> Source: ISO/IEC 17021:2011, 9.1.2.2.3

We think that the issue of 'scope' might cause some confusion. Why do we say this? Well, we pointed out previously that ISO 50001 is different from other MSSs in that it has the concept of scope and the concept of boundary. This is what we said previously:

> Please do not confuse scope and boundaries. All MSSs require a written declaration of scope. ISO 50001 goes beyond this because it also requires you to define boundaries. Why is this? The answer is that the energy management system (EnMS) described by ISO 50001 involves measurement. For example, establishing energy efficiency involves measuring 'an output of performance, service, goods or energy, and an input of energy'. But just what output and input are we talking about here? Or, put in other words, what are the limits of this measurement? This is where the term 'boundary' is used.

We make no apology for repeating this text. Our concern is that not only must you understand the difference between scope and boundary, but so

must any auditor. Remember *you* define what the scope of your ISO 50001 implementation is, and *you* define what boundaries are applicable within that scope. It is entirely appropriate that an auditor challenges and discusses your decisions with you, but an auditor cannot change them and must ensure that the audit does not go outside them.

Having said that, please also remember that a key concept of ISO 50001 is that of 'significant energy use'. This is how significant energy use is defined:

> **significant energy use**
> energy use accounting for substantial energy consumption and/or offering considerable potential for energy performance improvement
>
> NOTE Significance criteria are determined by the organization.
>
> Source: ISO 50001:2011, 3.27

Pay special attention to the note. The auditor is likely to ask you to explain the rationale behind your determination of what your 'significant energy use' is.

Criteria

It is convenient for us to revert to the table format to discuss audit criteria, but make no mistake – getting the audit criteria right is fundamental to your chances of a successful implementation of ISO 50001. Table 6 gives our advice on audit criteria.

Table 6: Audit criteria

ISO/IEC 17021 requirements	Our advice
9.1.2.2.4 The audit criteria shall be used as a reference against which conformity is determined, and shall include:	Note just how important audit criteria are. Please make sure that you have agreed and understand them. And, by the way, this applies as much to self-declaration of conformity as it does to the third-party conformity assessment that we are focusing on here.
– the requirements of a defined normative document on management systems;	In other words, ISO 50001!
– the defined processes and documentation of the management system developed by the client.	There are a couple of things to talk about here. Firstly, this is the first mention of 'processes', yet ultimately everything in an MSS is related to

ISO/IEC 17021 requirements	Our advice
	processes.* Make sure that you understand what processes are within your scope and boundaries. Secondly, although here we see the term 'documentation', remember that it is not just documentation that an auditor will be looking at – as we shall soon see. Hence ISO's reference to 'the process approach' in ISO 9000, Clause 0.2 (Quality management principles), bullet d: 'A desired result is achieved more efficiently when activities and related resources are managed as a process.'

The 'evidence triangle'

In the very last sentence of Table 6, we reminded you that it is not just documentation that an auditor will be looking for. It is time for another extract from ISO/IEC 17021:

> Methods to collect information shall include, but are not limited to:
>
> a) interviews;
> b) observation of processes and activities;
> c) review of documentation and records.
>
> Source: ISO/IEC 17021:2011, 9.1.9.5.2

This makes it very clear that although documentation is important, the best documentation in the universe will not result in a successful audit if either interviews or simple observation show that what has been written down is not being carried out.

Auditors are trained to see whether the culture and practices of an organization demonstrate that the overall intention of the MSS – any MSS, but in our case ISO 50001 – has been realized. Here is a reminder of the intention of ISO 50001:

> This International Standard specifies requirements for establishing, implementing, maintaining and improving an energy management system, whose purpose is to enable an organization to follow a systematic approach in achieving continual improvement of energy performance, including energy efficiency, energy use and consumption.
>
> Source: ISO 50001:2011, Scope

Finally, let us explain why this section is titled 'The evidence triangle'. Within ISO, the phrase 'evidence triangle' is frequently used as shorthand for:

a) interviews;
b) observation of processes and activities; and
c) review of documentation and records.

Please do not forget!

Chapter 7 – Documentation

Introduction

Our experience is that documentation can assume gargantuan dimensions – dimensions that are frequently out of all proportion to the overall importance of documentation. This is a great shame, because all that is required is a common-sense approach to providing 'the evidence' in the form of documentation or records.

We are going to look at documentation pretty thoroughly, because ISO 50001 contains 30 references to documents and 19 to records. However, before we start, let us remind you again that it is not just documentation that an auditor will look at: do not forget the interviews and simple observations.

What does 'documentation' mean?

To start with, we need to guide you through the terminology that surrounds documentation. We need to do this in order to show you that documentation is not the same as paperwork. In the main we have kept to terms and definitions contained in ISO 50001. However, when we started writing this book, we found – somewhat to our surprise – that although the term 'record' had been defined by ISO 50001, the terms 'document' and 'documentation' had not. Also, some of these words take the form of both nouns and verbs.

All of this meant that we had to look at some terms and definitions that come from other sources before we could show you how to make sense of the requirements contained in ISO 50001. The table that summarizes all the sources is rather large, but we have included it as Appendix A.

Please look at the table as and when necessary. In the meantime, here is our common-sense advice on how to deal with documentation, starting with a summary of the key lessons to be learned from our analysis of the terminology surrounding 'documentation':

- Within ISO, a document is information, and information is meaningful data.
- This meaningful data is frequently turned into information by gathering and presenting the data in a predetermined way. For

example, forms have a prescribed layout and content; so do reports, specifications, drawings, and so on.

- A document (as defined by ISO) can take a variety of forms. These include paper, magnetic tape, optical discs, photographs, and even the binary code used by software.[4] (From now on, whenever you see the word 'document', please assume that we are using it in the ISO context, unless we say differently.)
- The word 'documentation' is a noun, and documentation is best thought of as a collection of documents.
- A record is essentially a document (as defined by ISO) that provides evidence about the past; in the case of ISO 50001, this is explicitly restricted to:
  - 'stating results achieved'; or
  - 'providing evidence of activities performed'.
- Be careful to read the context in which any words relating to documentation are written. In particular, take care to differentiate between words being used as a noun or as a verb. (To help you, we will always indicate whether we are using the words as a noun or as a verb.)

What documents must I keep?

This must be one of the most-often-asked questions about any MSS. The answer is not 'those that the MSS in question says that I must keep'. Why not? It is the same old answer: because you need to keep whatever evidence is needed to show that you have fulfilled the requirements of the relevant MSS. Look at it like this: yes, most MSSs tell you that certain documents must be kept. If you do not keep these documents, then you will not be able to attest that you comply with the requirements of the MSS, or receive a certificate saying that you do; in other words, this is the minimum set of documents that will be required. But do not be surprised if there are other documents on top of this minimum set that may be required.

The remainder of this chapter lists every reference to a document in ISO 50001, together with some advice from us, including our view on whether we are dealing with a noun or a verb. We also give more information and advice on documentation in Part C. But please remember: your goal should not be to over-document. Aim to optimize your level of documentation to one that is appropriate to your needs and to the requirements of ISO 50001.

[4] This can be particularly confusing, because most people think of a document as being something written down, even if it is written down in the sense of using a word processor and then printing the resultant 'document' off. What ISO has done is to use an obsolete definition of the word 'document' which is 'evidence, proof'.

All references in ISO 50001:2011 to documentation

Introduction, paragraph 2
This International Standard applies to the activities under the control of the organization, and application of this International Standard can be tailored to fit the specific requirements of the organization, including the complexity of the system, degree of documentation, and resources.

Well, we guess it is clear enough that 'documentation' is very important!

1 Scope, paragraph 2
This International Standard specifies requirements applicable to energy use and consumption, including measurement, documentation and reporting, design and procurement practices for equipment, systems, processes and personnel that contribute to energy performance.

Again, we guess it is clear enough that 'documentation' is very important!

3.20
internal audit
systematic, independent and documented process for obtaining evidence and evaluating it objectively in order to determine the extent to which requirements are fulfilled

Do not forget that you need to document (verb) the process for your internal audits.

3.24
procedure
specified way to carry out an activity or a process

NOTE 1 Procedures can be documented or not.

NOTE 2 When a procedure is documented, the term 'written procedure' or 'documented procedure' is frequently used.

NOTE 3 Adapted from ISO 9000:2005, definition 3.4.5.

An example of a documented procedure in ISO 50001 is the energy review.

3.25
record
document stating results achieved or providing evidence of activities performed

NOTE 1 Records can be used, for example, to document traceability and to provide evidence of verification, preventive action and corrective action.

NOTE 2 Adapted from ISO 9000:2005, definition 3.7.6.

Remember the ISO definition of the term 'document'. Also remember to read the note that is attached to this definition. It is a reasonable expectation that there will be some documentation of the activities that the note refers to.

4.1 General requirements
The organization shall:
a) establish, document, implement, maintain and improve an EnMS in accordance with the requirements of this International Standard;
b) define and document the scope and boundaries of its EnMS;

Just in case you have forgotten how important documentation is! Note that you have to document not just the scope (singular) but also the detail of all of your boundaries.

4.3 Energy policy
The energy policy shall state the organization's commitment to achieving energy performance improvement. Top management shall define the energy policy and ensure that it: ...

Do not miss any of the requirements here, but also do not be too put off by them all. It is perfectly possible to have a very short energy policy and yet still meet all of the requirements of 4.3.

4.4 Energy planning
4.4.1 General
The organization shall conduct and document an energy planning process.

Here the word 'document' is being used as a verb. Take care to read the entire clause, because it gives a very clear indication of what the subjects to be documented might be.

4.4.3 Energy review
The organization shall develop, record, and maintain an energy review. The methodology and criteria used to develop the energy review shall be documented. To develop the energy review, the organization shall:
...
c) identify, prioritize and record opportunities for improving energy performance.

Here the word 'record' is being used as a verb. Again, the clause gives some useful tips on what should be documented. Do not miss any of the requirements here. Read the clauses carefully and make sure that you can tick off all the slightly hidden requirements, such as 'methodology', 'criteria', 'prioritize', 'record', and so on.

> **4.4.2 Legal requirements and other requirements**
> The organization shall identify, implement, and have access to the applicable legal requirements and other requirements to which the organization subscribes related to its energy use, consumption and efficiency.

Yes, you are right – the word document is not used here. However, if you can think of any way that allows you to comply with this clause that does not involve some form of documentation, then please let us know.

> **4.4.4 Energy baseline**
> The energy baseline(s) shall be maintained and recorded.

The concept of baseline is very important to any energy management system (EnMS). So we think it is wise for you to pay particular attention here. Make sure that your documentation results in a series of 'records' sufficient to reconstruct a set of baselines.

> **4.4.5 Energy performance indicators**
> The organization shall identify EnPIs appropriate for monitoring and measuring its energy performance. The methodology for determining and updating the EnPIs shall be recorded and regularly reviewed.

Here is another example of where the documentation must result in a series of records: apply the concept of substitution. Also, do not forget that there needs to be evidence of a regular review.

The use of the word 'appropriate' makes anything to do with energy performance indicators (EnPIs) rather subjective. However, a lot of this subjectivity can be overcome by being able to refer to your methodology.

> **4.4.6 Energy objectives, energy targets and energy management action plans**
> The organization shall establish, implement and maintain documented energy objectives and targets at the relevant functions, levels, processes or facilities within the organization. Time frames shall be established for achievement of the objectives and targets.

Do not miss the hidden requirements! Words such as 'relevant functions, levels, processes or facilities' combined with 'time frames' are all there for a purpose.

> **4.4.6 Energy objectives, energy targets and energy management action plans**
> The organization shall establish, implement and maintain action plans for achieving its objectives and targets. ... The action plans shall be documented, and updated at defined intervals.

Our consistent advice 'to make sure that you can tick off all the requirements' applies here. Also, do not overlook the requirement that action plans 'shall' be updated.

> **4.5.2 Competence, training and awareness**
> The organization shall ensure that any person(s) working for or on its behalf, related to significant energy uses, are competent on the basis of appropriate education, training, skills or experience. The organization shall identify training needs associated with the control of its significant energy uses and the operation of its EnMS. The organization shall provide training or take other actions to meet these needs.
>
> Appropriate records shall be maintained.

Here we have the use of the word 'appropriate' (two times) and the term 'records' (noun). 'Appropriate' is subjective. What is important in the first instance, is that you document your rationale for deciding what 'education, training, skills or experience' is appropriate; do not make life difficult for yourself by straying outside of the significant energy uses that you will have already established.

The same advice applies to the second use of the word 'appropriate'. Remember that 'records' is a good indication that you may be required to produce historical evidence.

> **4.5.2 Competence, training and awareness**
> The organization shall ensure that any person(s) working for or on its behalf are aware of:
> a) the importance of conformity with the energy policy, procedures and the requirements of the EnMS;
> b) their roles, responsibilities and authorities in achieving the requirements of the EnMS;
> c) the benefits of improved energy performance;
> d) the impact, actual or potential, with respect to energy use and consumption, of their activities and how their activities and behaviour contribute to the achievement of energy objectives and targets, and the potential consequences of departure from specified procedures.

Another example of where the word 'document' is not used. However, again, if you can think of any way that allows you to comply with this clause that does not involve some form of documentation, then please let us know.

Make sure that you cover all the requirements.

4.5.3 Communication

The organization shall communicate internally with regard to its energy performance and EnMS, as appropriate to the size of the organization.

The organization shall establish and implement a process by which any person working for, or on behalf of, the organization can make comments or suggest improvements to the EnMS.

The organization shall decide whether to communicate externally about its energy policy, EnMS and energy performance, and shall document its decision. If the decision is to communicate externally, the organization shall establish and implement a method for this external communication.

A good place in which to document your decision about whether to communicate externally about your energy policy is in your energy policy document!

4.5.4 Documentation

Pay particular attention to this part of the standard.

4.5.4.1 Documentation requirements

The organization shall establish, implement and maintain information, in paper, electronic or any other medium, to describe the core elements of the EnMS and their interaction.

The EnMS documentation shall include:

a) the scope and boundaries of the EnMS;
b) the energy policy;
c) the energy objectives, targets, and action plans;
d) the documents, including records, required by this International Standard;
e) other documents determined by the organization to be necessary.

NOTE The degree of documentation can vary for different organizations for the following reasons:

- the scale of the organization and type of activities;
- the complexity of the processes and their interactions;
- the competence of personnel.

Take care! This is not an inclusive list. We have already seen that there are other documents that you will be expected to keep. (This is why we prepared these comments on the references to documentation.)

Also, do take note of the Note. Make sure that your documentation is fit for purpose and does not go 'over the top'.

4.5.4.2 Control of documents
Documents required by this International Standard and the EnMS shall be controlled. This includes technical documentation where appropriate.

The organization shall establish, implement and maintain procedure(s) to:
a) approve documents for adequacy prior to issue;
b) periodically review and update documents as necessary;
c) ensure that changes and the current revision status of documents are identified;
d) ensure that relevant versions of applicable documents are available at points of use;
e) ensure that documents remain legible and readily identifiable;
f) ensure documents of external origin determined by the organization to be necessary for the planning and operation of the EnMS are identified and their distribution controlled;
g) prevent the unintended use of obsolete documents, and suitably identify those to be retained for any purpose.

Please refer to our advice contained in the next section.

4.5.6 Design
The results of the design activity shall be recorded.

Here the word 'recorded' is a verb. The clause could have said 'documented'.

Another example of hidden requirements, so take care to read the clause carefully.

Clearly, the 'design activity' process will vary from organization to organization. So it may be that your documentation amounts to nothing more than a couple of paragraphs. On the other hand, it could be quite extensive.

Always remember, though, that the only design activity that matters (as far as the standard is concerned) is that which falls within your declared scope.

4.5.7 Procurement of energy services, products, equipment and energy
When procuring energy services, products and equipment that have, or can have, an impact on significant energy use, the organization shall inform suppliers that procurement is partly evaluated on the basis of energy performance.

The organization shall establish and implement the criteria for assessing energy use, consumption and efficiency over the planned or expected operating lifetime when procuring energy using products, equipment and services which are expected to have a significant impact on the organization's energy performance.

The organization shall define and document energy purchasing specifications, as applicable, for effective energy use.

This clause has many subjective words in it. So our previous advice about realizing the importance of your scope statement, and documenting the rationale for your decisions, comes to the fore.

4.6.1 Monitoring, measurement and analysis
The organization shall ensure that the key characteristics of its operations that determine energy performance are monitored, measured and analysed at planned intervals. Key characteristics shall include at a minimum:
a) significant energy uses and other outputs of the energy review;
b) the relevant variables related to significant energy uses;
c) EnPIs;
d) the effectiveness of the action plans in achieving objectives and targets;
e) evaluation of actual versus expected energy consumption.

The results from monitoring and measurement of the key characteristics shall be recorded.

An energy measurement plan, appropriate to the size and complexity of the organization and its monitoring and measurement equipment, shall be defined and implemented.

This is another case of 'recorded' being used as a verb: you need to document the 'key characteristics'. (We suggest that this should include their initial definition as well as the results from their monitoring and measurement.)

Quite often, we are asked about what the term 'characteristic' means. So, in order to help you, we've repeated the definition from ISO 9000. It is worth spending a little time reading through the definition and the notes.

3.5.1
characteristic
distinguishing feature

NOTE 1 A characteristic can be inherent or assigned.

NOTE 2 A characteristic can be qualitative or quantitative.

NOTE 3 There are various classes of characteristic, such as the following:
- physical (e.g. mechanical, electrical, chemical or biological characteristics);
- sensory (e.g. related to smell, touch, taste, sight, hearing);
- behavioural (e.g. courtesy, honesty, veracity);
- temporal (e.g. punctuality, reliability, availability);
- ergonomic (e.g. physiological characteristic, or related to human safety);
- functional (e.g. maximum speed of an aircraft).

Source: ISO 9000:2005, 3.5.1

Our advice is that the 'energy measurement plan' referred to should be documented, although ISO 50001 does not specify this explicitly. This is, of course, related to the next clause.

> **4.6.1 Monitoring, measurement and analysis**
> The organization shall define and periodically review its measurement needs. The organization shall ensure that the equipment used in monitoring and measurement of key characteristics provides data which are accurate and repeatable. Records of calibration and other means of establishing accuracy and repeatability shall be maintained.

Again, our advice is that the definition and review of 'measurement needs' should be documented.

This clause uses the term 'record(s)' as a noun. Therefore you will need to create documents related to 'calibration and other means of establishing accuracy and repeatability' and keep them. These documents will then become records.

> **4.6.1 Monitoring, measurement and analysis**
> The organization shall investigate and respond to significant deviations in energy performance.
>
> Results of these activities shall be maintained.

Our advice is that the results of your activities here should be documented, although, again, this is not made explicit in ISO 50001.

> **4.6.2 Evaluation of compliance with legal requirements and other requirements**
> At planned intervals, the organization shall evaluate compliance with legal requirements and other requirements to which it subscribes related to its energy use and consumption.
>
> Records of the results of the evaluations of compliance shall be maintained.

Yet again, our advice is to document your evaluation, and these documents will then become records.

> **4.6.3 Internal audit of the EnMS**
> Records of the audit results shall be maintained and reported to top management.

Although it is not made explicit here, we have already seen that the definition of an 'internal audit' makes it clear that this activity must be documented.

Our normal advice about ensuring that you check off all of the requirements applies.

> **4.6.4 Nonconformities, correction, corrective action and preventive action**
> The organization shall address actual and potential nonconformities by making corrections, and by taking corrective action and preventive action, including the following:
> ...
> e) maintaining records of corrective actions and preventive actions;
> ...
>
> Corrective actions and preventive actions shall be appropriate to the magnitude of the actual or potential problems and the energy performance consequences encountered.
>
> The organization shall ensure that any necessary changes are made to the EnMS.

Paying attention to nonconformities is at the heart of continuous improvement. So it is not surprising that you need to pay particular attention to documentation here.

Document the activities specified in Clause 4.6.4, and these documents will then become the records that are being looked for.

Perhaps a good way of approaching the word 'appropriate' is to substitute 'fit for purpose'. ISO's definition of 'fitness for purpose' is 'ability of a product, process or service to serve a defined purpose under specific conditions' – see *ISO/IEC Guide 2:2004*, 2.1.

We think that it is entirely appropriate that you document why you thought that changes were necessary to the EnMS; remember to think about any changes that may be necessary to your energy policy.

> **4.6.5 Control of records**
> The organization shall establish and maintain records, as necessary, to demonstrate conformity to the requirements of its EnMS and of this International Standard, and the energy performance results achieved.
>
> The organization shall define and implement controls for the identification, retrieval and retention of records.
>
> Records shall be and shall remain legible, identifiable and traceable to the relevant activity.

If you have got to this point, you will by now understand pretty well what documentation is required by ISO 50001. Not all of this documentation turns into records (remembering that we are talking here about the ISO 50001 definition of 'records', see page 43). However, our advice is to always err on the side of caution, and if in doubt to keep a record, especially until you have gone through your first cycle of self-declaration or attestation.

The phrase 'as necessary' introduces subjectivity. As before, we recommend that you use the ISO definition of 'fitness for purpose', where the purpose is set out in your statement of scope and statement(s) of boundaries.

See the next section for more advice on controlled documents.

> **4.7 Management review**
> **4.7.1 General**
> At planned intervals, top management shall review the organization's EnMS to ensure its continuing suitability, adequacy and effectiveness.
>
> Records of management review shall be maintained.

The requirement here is to document the management review, and once you have done that these documents will form your records.

Very specific requirements are set out in 4.7.2 and 4.7.3 regarding the inputs and outputs to the management review. Make sure that these are clearly visible in your documentation.

What is meant by 'controlled' documents?

There is a very simple intent behind the requirement for some documents to be controlled. But what does the word 'controlled' mean? We'll answer this question by looking firstly at the word 'control'. You may be surprised to know that the *Shorter Oxford English Dictionary* lists five main definitions for the word 'control'. Of these, the following is the most appropriate for our use:

> 1 a: Check or verify and hence regulate (accounts etc.), orig. by comparison with a duplicate register. b: gen. Check the accuracy of (a statement etc.).
>
> Source: *Shorter Oxford English Dictionary*, Fifth Edition

If we use this definition, then it is entirely reasonable to say that 'controlled documents' are documents that are subject to some form of regulation, and that this regulation is there so as to ensure that anybody using these documents can be sure that they are using the right ones. This is exactly the intent of ISO.

How then do you control documents? If you are ever in doubt about how to control documents, remember that the overall intent is always to ensure that anybody who uses a document uses the correct document – and that it is available and can be 'read'.

Control of documents

> 4.5.4.2 Control of documents
> Documents required by this International Standard and the EnMS shall be controlled. This includes technical documentation where appropriate.
>
> The organization shall establish, implement and maintain procedure(s) to:
> a) approve documents for adequacy prior to issue;
> ...

Make sure that your energy policy states who is authorized to approve controlled documents. *Do not* fall into the trap of making a senior manager responsible for approving all documents. Take some time to work out which ones really do need senior management approval, and which ones can be delegated.

Also, if you have decided to appoint an 'energy manager', it is likely that this person will want to be part of the approval process.

> b) periodically review and update documents as necessary;

It is good practice to carry out a review of all your controlled documents at least once a year. It is a good idea to have a register of controlled documents and to record which version of the document is the current version and to record when each document was last reviewed.

As well as this annual review, whenever a controlled document requires change (perhaps because the process or procedure that it relates to has changed), also take the time to review associated controlled documents.

> c) ensure that changes and the current revision status of documents are identified;

The intent here is that all controlled documents should have on them (in analogue or digital form) sufficient detail such that their status can be easily identified. The following details should suffice:

- A unique identifier for each document. This does not need to be complicated; a simple incremental number will do.
- A date indicator.
- A revision indicator. Again this can be quite simple, such as 'Rev. A' or 'Rev. 001'.
- A status indicator. It is useful to think about the flow of the process by which a document is either created or revised. A detailed flow might go along the lines of: working draft(s); draft for comment; draft for agreement; issued; withdrawn; archived. You may not need all of the stages, but do make sure that the status of each document

is clearly stated on the document, and remember that each document will need a unique identifier.
- An 'origin' indicator(s). Normally the information includes: the originating department; the originator; the originator's manager; the approving manager (where the originator or the originator's manager is not authorized to approve the document).

It is also useful to make sure that each page (or equivalent) is numbered.

> d) ensure that relevant versions of applicable documents are available at points of use;

This may seem like an obvious statement, but remember that if the document takes the form of, for example, a microfiche, you need to provide a microfiche reader at all the points where that document might be used.

> e) ensure that documents remain legible and readily identifiable;

We have talked about identification above, but what about the word 'legibility'? Remember that the ISO definition of 'document' applies to many forms or types of media. So, to continue with the microfiche example, remember to make sure that the screen of the microfiche reader is clean, and that the microfiche itself is not scratched.

> f) ensure documents of external origin determined by the organization to be necessary for the planning and operation of the EnMS are identified and their distribution controlled;

The easiest way to do this is to allocate each document a unique document number and then to treat the documents as any other controlled document.

> g) prevent the unintended use of obsolete documents, and suitably identify those to be retained for any purpose.

The easiest way to prevent the unintended use of obsolete documents is to make diligent use of a document register. Make sure that when you issue a new version of the document, you recall the previous version (or make it not available, if you are using a computerized document management system). Some people physically over-stamp paper documents with 'Superseded' or 'Withdrawn'.

Chapter 8 – At last! Getting started – the ISO process approach

Introduction

Subclause 4.5 of ISO 50001 is called 'Implementation and operation', so you might wonder why there is a need for our book at all! Well, we want to help you understand how ISO 50001 fits into the overall family of management system standards (MSSs), and of course we want to help you understand all the requirements of ISO 50001. But there is also a need to give you some guidance on what to do first, second, third and so on once you have decided to implement ISO 50001.

You cannot carry out all of the requirements for 'implementation' in subclause 4.5 until you have implemented all of what we call the 'enabling' processes that you need. For example, you cannot conduct a survey or a stocktake of all of the energy that you use, why you are using it, and what uses it, before you have in place all of the management processes that you will need to carry out these activities, i.e. all of the resources, measurement devices and so on.[5] Only then can you actually carry out the review and decide on your targets and objectives. Once you have done that, you can then use the system – you can 'implement' it.

It can be confusing. For example, ISO 50001 states that the standard is based on the principles of the Plan, Do, Check, Act (PDCA) cycle. This is true, as we shall see, especially in respect of the ongoing operation ('implementation') of the system once it is in place. However, it is more appropriate to use a specific ISO methodology called the 'process approach' as the foundation for actually putting the system into place.

So this chapter takes you through the ISO 'process approach', demonstrates how you can use it as a framework for the implementation of the EnMS, and also demonstrates the great use that can be made of the PDCA cycle.

[5] As we shall see later, ISO 50001 uses the term 'energy review' to describe these essential activities. Some energy professionals also use the term 'energy audit' to describe the same or very similar activities. We do not want to get into a debate about which term is better than the other, but we need simply to point out that for successfully implementing ISO 50001, you must stick with the definition of an 'energy review' as given in ISO 50001 (see Appendix A).

The process approach and the PDCA cycle – what is the difference?

All MSSs are based on what ISO terms the 'process approach'. ISO 50001 is – as we have seen – an MSS, and therefore this too has at its heart the concept of process. The first thing that we need to do is to explain that the ISO process approach and the PDCA cycle are different things. They both offer a lot of benefit and, in our view, if you use them in conjunction with each other it will make implementation of ISO 50001 simpler. But you do need to understand both the ISO process approach and the PDCA cycle in order to get maximum advantage.

A short summary of each might be:

- The process approach is a framework, based on processes, for the design, implementation, maintenance and management of a system – often all of the systems that together make up an organization.[6]

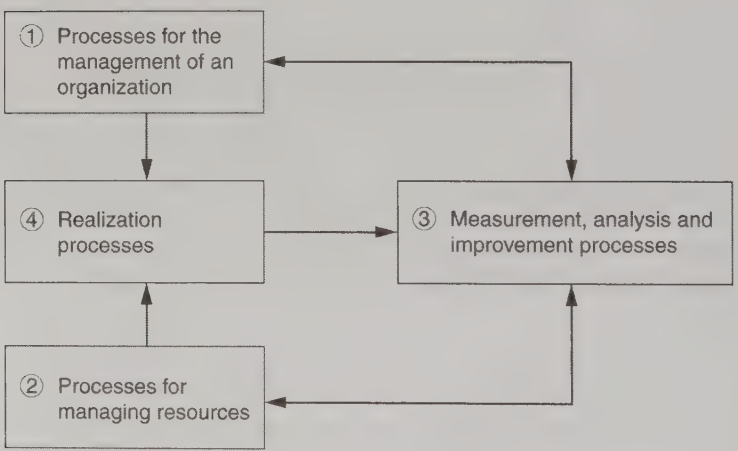
① Processes for the management of an organization
④ Realization processes
③ Measurement, analysis and improvement processes
② Processes for managing resources

Figure 1: The ISO grouping processes

- The PDCA cycle is a sequence of six repetitive steps which provide a systematic methodology for managing change, and particularly changes necessary to put right something that has gone wrong. (ISO calls this a 'correction'.[7]) The PDCA cycle originates from the 'Shewhart cycle', first published in 1939. It was adapted by Demming

[6] The application of a system of processes within an organization, together with the identification and interactions of these processes, and their management to produce the desired outcome, can be referred to as the 'process approach'. Source: ISO 9001.

[7] correction: action to eliminate a detected nonconformity Source: ISO 50001, 3.3.

as the 'PDSA' cycle, which was then adapted again to form the PDCA cycle as used by ISO; see Figure 2 below.

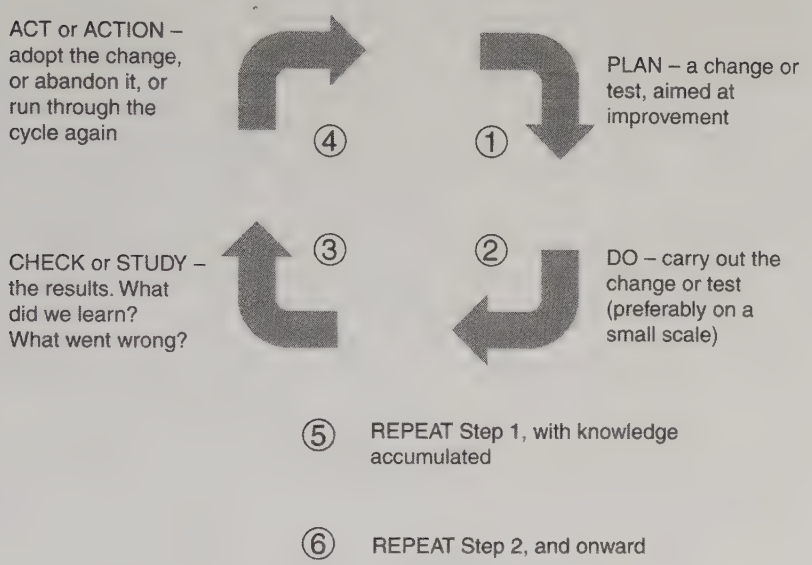
ACT or ACTION – adopt the change, or abandon it, or run through the cycle again
④
①
PLAN – a change or test, aimed at improvement
CHECK or STUDY – the results. What did we learn? What went wrong?
③
②
DO – carry out the change or test (preferably on a small scale)
⑤ REPEAT Step 1, with knowledge accumulated
⑥ REPEAT Step 2, and onward

Figure 2: The PDCA cycle

Why is the difference between the process approach and the PDCA cycle so important?

Project management

The biggest difference between the ISO process approach and the PDCA cycle is in respect of project management. Purists would say that you should formally manage every project: *ergo* 'project management'. Certainly we believe that the implementation of ISO 50001 is worthy of project management.

It is not our intention here to give advice on the various methodologies that can be applied to project management, although BS 6079–1:2010, *Project Management – Principles and guidelines for the management of projects*, is a good place to start. However, we are bold enough to suggest that there are some basic principles that most people agree on:

- Every project has a start and a finish.
- Virtually every project is best managed and carried out in stages/phases.

Now you could say that the PDCA cycle (and indeed other similar continuous improvement methodologies, such as Six Sigma) has a start and finish. But that would be misleading. The PDCA is a cycle. The intent is that you repeat the cycle until the reason for starting the cycle in the first place has gone away: which is why you have steps 5 and 6 (shown in Figure 2). This is why PDCA is such a powerful tool for dealing with things that have 'gone wrong', or to use the ISO term, to deal with a 'nonconformity'.

In the great majority of cases the thing that has gone wrong is a process. But where do these processes come from in the first place? What are they? How are they measured? Are those measurements monitored in such a way that a 'nonconformity' can be detected? As we have said previously, although the PDCA cycle can be applied to any process, there needs to be a process there in the first place.

The best way of making sure that you have all of the necessary processes in place before your EnMS can go to work, is to regard the initial implementation of the EnMS as a stand-alone project, with a defined start and finish. Then use the ISO process approach as the basis for the grouping and order in which the various ISO 50001 processes are put in place.

Project management and the process approach, if used in this way, go a long way to making sure that 'the system of processes within an organization, together with the identification and interactions of these processes', referred to in footnote 6, does go in place. It is within this system that the PDCA cycle can then be used as a tool to manage continuous improvement. Please do not misunderstand us. We think that the PDCA cycle is an excellent tool, as we demonstrate next, but we also think that it is most effective when used within a system of interrelated processes as described by the ISO process approach.

Continuous improvement

But then again, there are things that the PDCA cycle does better than classic project management. For example, because the PDCA cycle is a sequence of four repetitive steps, not only can it be used as originally intended for the management of change, it can also be used as the basis of operations for a system. One of the most important parts of ISO 50001 is the concept of an 'energy review', which we talked about earlier. As a reminder, here is what this is:

> energy review
> determination of the organization's energy performance based on data and other information, leading to identification of opportunities for improvement
>
> Source: ISO 50001:2011, 3.15

We will be discussing 'energy performance' in the next chapter, and it does not really matter exactly what it is for our present discussion. What does matter is that you can see that this energy review is the driver for continuous improvement. It is like when you see a doctor who examines you in order to make an initial, sometimes preliminary, diagnosis of your ailments (let us hope that there are few!), following which there may then be further investigation and a more detailed diagnosis. Indeed, this is why in some countries an energy review is termed an 'energy diagnosis'. But the energy review can only be a driver for continuous improvement if it is carried out time and time again – which is what ISO 50001 requires you to do.

It is the results of these repetitive energy reviews that, if properly designed and carried out, will bring to your attention the things that have gone wrong that need to be put right. This is what the four repetitive steps of the PDCA cycle are so good for. Or to put it in ISO terms, the energy review should bring to your attention nonconformities that require correction.

Please do not think of PDCA cycles as being stand-alone events; they are not. It is much better to think of them as matryoshka dolls: the Russian dolls that nest one within the other. It is entirely possible to have a PDCA cycle that fits in one quadrant of a higher-level PDCA cycle, and for that to happen many times. Thought of in this way, it is easy to see how powerful the PDCA approach can be in sustaining continuous improvement.

The PDCA and ISO 50001

So how does the PDCA cycle work within ISO 50001? Well, firstly here is what the standard itself says:

> This International Standard is based on the Plan – Do – Check – Act (PDCA) continual improvement framework and incorporates energy management into everyday organizational practices, as illustrated in Figure 1.
>
> NOTE In the context of energy management, the PDCA approach can be outlined as follows:
>
> - Plan: conduct the energy review and establish the baseline, energy performance indicators (EnPIs), obectives, targets and action plans necessary to deliver results that will improve energy performance in accordance with the organization's energy policy;
> - Do: implement the energy management action plans;
> - Check: monitor and measure processes and the key characteristics of operations that determine energy performance against the energy policy and objectives, and report the restults;
> - Act: take actions to continually improve energy performance and the EnMS.
>
> Source: ISO 50001:2011, Introduction

This is then illustrated by means of *Figure 1* from ISO 50001, which is mentioned in the quotation on page 59. We have reproduced the figure below, and it is labelled Figure 3 in this book.

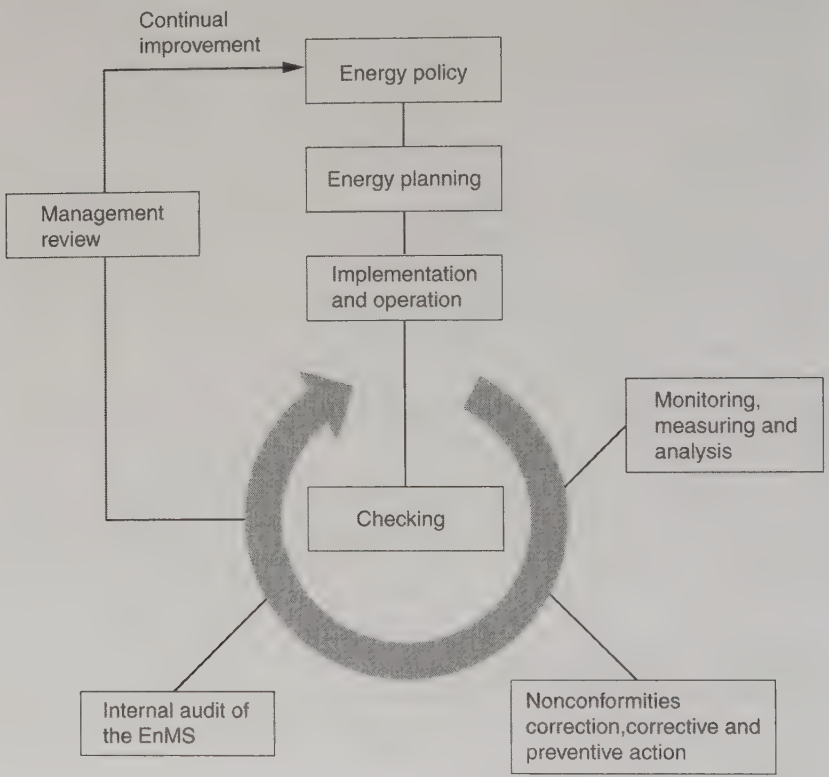

Figure 3: ISO 50001 PDCA Cycle

Source: ISO 50001:2011, Figure 1

The point is simple: neither the Introduction to ISO 50001 nor its PDCA cycle diagram set out all of the processes that you must implement for a successful implementation of ISO 50001.

Take a look at Table 7 on page 61. It summarizes how ISO 50001 describes the use of the PDCA cycle in the context of energy management. Column (a) shows you what the Introduction to ISO 50001 says regarding the PDCA cycle, and column (b) is an extract from the PDCA cycle diagram that relates some clauses from ISO 50001 to P, D, C or A.

Column (b) has seven entries, but the requirements clause of ISO 50001 has 31 subclauses. Each of the 'missing' 24 subclauses contains requirements, and those requirements are in the main related to processes. Therefore it is important that you do not overlook any of the subclauses as you start to design, install and then commission your EnMS. The following section shows you how the process approach can be used to make sure that you do not overlook any requirements!

Table 7: The ISO 50001 PDCA cycle and energy management

	From the Introduction	From Figure 3
Plan	'Conduct the energy review and establish the baseline, energy performance indicators (EnPIs), objectives, targets and action plans necessary to deliver results that will improve energy performance in accordance with the organization's energy policy'	'Energy policy', 'Energy planning'
Do	'Implement the energy management action plans'	'Implementation and operation'
Check	'Monitor and measure processes and the key characteristics of operations that determine energy performance against the energy policy and objectives, and report the results'	'Monitoring, measurement and analysis', 'Management review', 'Internal audit of the EnMS'
Act	'Take actions to continually improve energy performance and the EnMS'	'Nonconformities, correction, corrective and preventive action'

Implementing the process

First things first

So where do I start? What comes first, and how will I be sure that I have not missed any processes? The point that we are making, and it is an important one, is that there are a lot of processes that you need to put in place before you can start *using* your EnMS. ISO 50001 contains 24 subclauses of requirements – if by now you have forgotten what a requirement is, then please go back and read Chapter 1. Each requirement is related in some way to a process. Making sure that you put all of these processes in place and that you do so in a way that

complies with ISO 50001 can at first seem rather daunting – which is, of course, why we have written this book! Please be reassured. Part C covers each of the processes that you will need in detail.

However, what Part C does not do is give you an overall view of what processes might be related to other processes. It does not show you how processes are grouped together, and neither does it give you an idea of what group of processes should be implemented first, second and so on; without this, it is difficult to see how you would project manage the implementation of ISO 50001.

So this is what we are going to do here. We are going to show you how the processes are grouped together, and by so doing give you a sense of the sequence in which these processes need to be implemented *before* you can start using your EnMS (the 'implementation' referred to in subclause 4.6).

Starting off

The first thing we are going to do is to remind you how ISO groups processes. Figure 1 on page 56 shows you the groupings. Table 8 shows more detail.

Table 8: The ISO grouping of processes

Processes for the management of an organization	Processes relating to strategic planning, establishing policies, setting objectives, ensuring communication, ensuring availability of resources for the other organization's quality objectives and desired outcomes, and for management reviews.
Processes for managing resources	Processes necessary to provide the resources needed for the organization's objectives and desired outcomes.
Realization processes	Processes that provide the desired outcomes of the organization.
Measurement, analysis and improvement processes	Processes needed to measure and gather data for performance analysis and improvement of effectiveness and efficiency. They include measuring, monitoring, auditing, performance analysis and improvement processes (e.g. for corrective and preventive actions).
Note Measurement processes are often documented as an integral part of the management, resource and realization processes; whereas analysis and improvement processes are treated frequently as autonomous processes that interact with other processes, receive inputs from measurement results, and send outputs for the improvement of those processes.	

All of these process groups are related to each other. For example, the 'realization' group needs resources, is controlled by management and often provides data for measurement and analysis. (The technical committee responsible for the process approach is TC 176. It has published a very useful guide on the process approach, which is available for free download.[8] If you want a thorough understanding of the process approach, we recommend that you download and read the document.)

As we explained earlier, one of the benefits of grouping processes in this way is that it allows you to see the order in which to implement processes, which in turn forms the basis of a project plan.

For example, you can see that the first thing to do is to put in place those processes that relate to management. We all know that this makes sense. It is always a good idea to make sure that you have top management on board (and hopefully have a clear, documented mandate from them, such as an agreed energy policy) before you start going too far down the implementation track. Similarly, it is useful to have the resources that you will need in place. For systems that rely heavily upon measurement (as with an EnMS) there is little point in beavering away on action plans unless you have the ability to measure the results of those plans. This is why Figure 1 on page 56 indicates that there is an order in which to implement processes.

Our grouping of the ISO 50001 processes

We think that a good understanding of the process approach, and of the group of processes, is so important that we have taken some time to review every single clause in ISO 50001 and have allocated each to the process group that – in our view – it most belongs to.

Of course, we found that some processes belong in more than one group, so we have made a primary and a secondary allocation. Also, you will find that some clauses contain sentences that relate to more than one process group. (This can also make it rather difficult to work out what to do first, second, third and so on.) When this occurs, we have indicated in parentheses which sentence we are talking about within each subclause.[9]

Tables 9–12 show you how each subclause (and often each sentence) in ISO 50001 relates to the four ISO process groups. If you implement these

[8] Document: ISO/TC 176/SC 2/N 544R3, *ISO 9000 Introduction and support package: guidance on the concept and use of the process approach for management systems*, available from www.iso.org/iso/home/standards/management-standards/iso_9000.htm [accessed 3 December 2012].

[9] Every sentence – which includes bulleted points, sub-paragraphs and Notes – has been given a number. So when you see '(2)' it means the reference is to the second sentence.

in the order of the four tables, you will give yourself an excellent chance of a successful implementation of ISO 50001.

Table 9: Processes for the management of an organization

As a primary allocation	As a secondary allocation
4 Energy management system requirements 4.1 General requirements 4.2 Management responsibility 4.2.1 Top management 4.2.2 Management representative 4.3 Energy policy 4.4 Energy planning 4.4.1 General 4.4.2 Legal requirements and other requirements 4.4.6 Energy objectives, energy targets and energy management action plans (1 to 3) 4.5.3 Communication (1 and 2) 4.5.6 Design (1) 4.6.1 Monitoring, measurement and analysis 4.6.5 Control of records (1)	4.4.2 Legal requirements and other requirements (2) 4.4.3 Energy review (1) 4.4.4 Energy baseline (5) 4.5.4.1 Documentation requirements (3 to 7) 4.5.4.2 Control of documents (1) 4.5.5 Operational control (2) 4.5.6 Design 4.5.7 Procurement of energy services, products, equipment and energy (1 to 3) 4.6.1 Monitoring, measurement and analysis (8) 4.6.4 Nonconformities, correction, corrective action and preventive action (8) 4.6.5 Control of records (2)

Table 10: Processes for managing resources

As a primary allocation	As a secondary allocation
4.4.5 Energy performance indicators (1) 4.5.2 Competence, training and awareness 4.5.4 Documentation 4.5.4.1 Documentation requirements 4.5.4.2 Control of documents	4.4.4 Energy baseline (1 and 6) 4.4.6 Energy objectives, energy targets and energy management action plans (1 and 2)

Table 11: Realization processes

As a primary allocation	As a secondary allocation
4.4.2 Legal requirements and other requirements (2) 4.4.3 Energy review (1 to 11) 4.4.4 Energy baseline 4.4.5 Energy performance indicators (2) 4.4.6 Energy objectives, energy targets and energy management action plans (4 to 12)	4.3 Energy policy (9) 4.4.4 Energy baseline (2 to 4) 4.4.5 Energy performance indicators (1) 4.6.1 Monitoring, measurement and analysis (1 & 7) 4.6.3 Internal audit of the EnMS (5 to 7)

As a primary allocation	As a secondary allocation
4.5.5 Operational control 4.5.6 Design (2 and 3) 4.5.7 Procurement of energy services, products, equipment and energy 4.6.1 Monitoring, measurement and analysis (7) 4.6.3 Internal audit of the EnMS (5 to 7) 4.6.4 Nonconformities, correction, corrective action and preventive action 4.6.5 Control of records (2 and 3)	

Table 12: Measurement, analysis and improvement processes

As a primary allocation	As a secondary allocation
4.4.2 Legal requirements and other requirements (3) 4.4.3 Energy review (12) 4.6 Checking 4.6.1 Monitoring, measurement and analysis (2 to 6) 4.6.2 Evaluation of compliance with legal requirements and other requirements 4.6.3 Internal audit of the EnMS (1 to 4) 4.7 Management review 4.7.1 General 4.7.2 Input to management review 4.7.3 Output from management review	4.5.2 Competence, training and awareness (1 to 7) 4.5.4.1 Documentation requirements (1 and 2) 4.5.4.2 Control of documents (2 to 8) 4.5.6 Design (1) 4.6.2 Evaluation of compliance with legal requirements and other requirements (2 and 7) 4.6.5 Control of records (1) 4.7 Management review, 4.7.1 General (2) 4.7.2 Input to management review 4.7.3 Output from management review 4.6.1 Monitoring, measurement and analysis (8, 9, 10 and 12)

Part B – Understanding core technical principles

Introduction to Part B

It is likely that the energy professionals who are reading this book will understand everything there is to know about the more technical aspects of energy management. However, because we want this book to be useful for non-energy professionals as well as energy professionals, Part B discusses three topics that should allow a useful conversation between the two types of readers. After all, as we said in our Introduction:

> 'If you do not have experience of energy management but do have experience of implementing MSSs, then this book should be sufficient for you to understand what consultancy/experience in relation to energy you need to find in order to augment your experience with MSSs.'

We had to be careful when deciding which topics to cover, because our book is not a technical one. Eventually we came to the conclusion that the following three topics are ones that non-energy professionals who are looking to lead an implementation of ISO 50001 or be part of an implementation team should be aware of:

- What kind of things you can do to conserve energy.
- What does ISO 50001 mean when it talks about 'energy performance'?
- If the old saying that 'if you cannot measure it, you cannot manage it' is true, then what is measurement?

Chapter 9 – Energy efficiency

Introduction

When ISO 50001 was being drafted, there was some discussion about whether to use the word 'conservation'. In fact, you will only find the word used once, which is at A.4.2 'Legal requirements and other requirements' where it says: 'Examples of legal requirements may include a national energy conservation regulation or law.'

Now the reason for this is that the laws of physics clearly show that energy cannot be conserved. This is true, but over time a much broader use of the word 'conservation' began to be accepted and people started using the phrase 'energy conservation measure' (ECM) as a way of describing activities that could save energy. In some parts of the world, ECM remains a well-used concept, but in others it is not.

Our book is published in the United Kingdom, so it is appropriate to take notice of what applies here. This means, of course, that we need to understand how the European Union (EU) views things related to energy.

On 14 November 2012, the *Official Journal of the European Union* (Volume 55) published a new EU Directive: 'Directive 2012/27/EU on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC'.

This Energy Efficiency Directive sets out how all the member countries of the EU are to conserve and/or save energy by means of improving energy efficiency. It is really important for any energy professional working in the EU to download, read and understand this directive, because it is the ultimate authoritative source in respect of terms, definitions and requirements in respect of energy efficiency within the EU. Most people simply refer to the directive as the 'EED'.

Energy efficiency

Different people have different definitions of what energy efficiency means. But the good news is that ISO 50001 and the EU appear to be pretty aligned, as you can see from the two definitions that we have reproduced below.

> 'energy efficiency' means the ratio of output of performance, service, goods or energy, to input of energy
>
> 2012/27/EU EED Article 2, Definition (4)

> **energy efficiency**
> ratio or other quantitative relationship between an output of performance, service, goods or energy, and an input of energy
>
> ISO 50001:2011, 3.8

The reason why this is important is because the EED then goes on to define what an 'energy efficiency improvement' is; and of course ISO 50001 provides the management framework within which to identify opportunities for such improvements, as well as the workflow by which to assess, prioritize and implement actions in order to realize these opportunities.

As we shall see in the following chapter, ISO 50001 regards energy efficiency as one component of energy performance. Most energy professionals will understand how the various components of energy performance – use, efficiency and consumption – come together. However, if you are not an energy professional, then it is helpful for you to have some idea of what kind of 'improvements' are being talked about – so that is what we will talk about now.

Energy efficiency improvement measures

In economics, it is common to talk about supply and demand. The same concepts are traditionally applied to energy as well, so you will often see the phrases 'supply side' and 'demand side'. It is reasonably easy to categorize some measures as being applicable to either the supply side or the demand side.

ISO 50001 is aimed primarily at the users of energy, in other words at the demand side. But there are some measures, such as installing a wind turbine, that could be categorized as either supply side or demand side. It is not our intention to enter into the debate about where a measure 'fits'. All we want to do is to highlight some of the possibilities so that a non-energy professional has a starting point. So you will find that we have not categorized measures by supply side or demand side.

What we think is much more important to understand is that some measures are technological, and some are societal. What is the difference? In simple terms, technological measures involve 'stuff'; that can mean either new, more efficient appliances or machines, or any other form of energy-using device. Or it can mean ensuring that existing devices have been configured so that they operate in as energy-efficient a way as possible.

Societal measures involve people and their behaviour – this is why we call them 'people-based' measures. They can be at an individual level, a family level, or indeed any other social grouping of people. An individual can consciously decide to reduce the level of heating in the space he or she occupies. Of course you can also do so as a group of individuals such as a family, or a group of coworkers.

It is important to bear this in mind, especially as energy reviews are carried out and analysed. Yes, of course it might make sense to replace existing light bulbs with more efficient light bulbs. But it also makes sense to make sure that these light bulbs, of whatever type, are used only when they need to be used – that they are switched off when there is no use for the light that they provide. This may seem a very common-sense thing to say, but it is amazing how often something is sensible but not common.

Technological energy efficiency improvement measures

Here, in Table 13, are just some of the technological measures that an energy review might bring to light. Please note the word 'some'.

Table 13: Examples of technological energy efficiency improvement measures

Aspect	Measure
Related to illumination	Install: high-frequency electronic ballasts; high-efficacy lamps; occupancy sensors; photo sensors. Consider greater use of daylight. During design, consider the orientation of buildings.
Related to electric motors	Install: high-efficiency motors; variable speed controls; synchronous belts and drives. Replace standard V belts with high-efficiency belts.
Related to air compressors	Reduce compressed air pressure and leaks. Recover compressor waste heat. Use outside air for the compressor intake. Use synthetic lubricants in compressors. Install larger header lines in compressed air systems.
Related to buildings	Install or improve: thermal insulation; energy-efficient windows; draught-proofing; energy-efficient heating and artificial lighting. During design, maximize the use of daylight and ambient temperature.
Related to machines	Use: energy-efficient domestic appliances; business machines; leisure machines; audio and visual devices.

Aspect	Measure
Related to temperature	See also 'Related to buildings', above. Install energy-efficient heating, ventilation and air conditioning devices. Ensure that such devices are properly configured for maximum energy efficiency.
Related to boilers	Install: condensate return systems; high-pressure condensate return systems; turbulators in boiler tubes; smaller boilers; feedwater preheater systems. Improve boiler combustion efficiency. Repair: steam traps; condensate leaks; steam leaks. Recover steam blowdown. Duct warm combustion air to boilers.
Energy use	Replace electric space heaters with natural-gas-fired boilers (cheaper to run); isolate sections that are not in operation; install renewably sourced energy.
Energy consumption	Ensure that the last one out turns off the light; implement better scheduling of resources or work patterns.
Generic	Install: chimney heat exchangers; covers for heated tanks; strip doors; chimney dampers; destratification fans; exhaust hoods for ovens; radiant heaters; chronostats; insulation on pipes, ovens, boilers, ducts and so on.

People-based energy efficiency improvement measures

Here, in Table 14, are some of the people-based measures that an energy review might bring to light.

Table 14: Examples of people-based energy efficiency improvement measures

Aspect	Measure
Related to illumination	Consider altering working patterns in order to make greater use of daylight hours. Ensure that illumination is 'fit for purpose' but no more – both in the workplace and in other areas such as car parks, roads, and so on. Reward the turning off of lighting when it is not needed.
Related to temperature	Consider altering working patterns in order to make greater use of ambient temperature. Reward the turning off of heating, ventilation or air conditioning devices when they are not needed.

Aspect	Measure
Related to motors	Do not overprovision lifts, escalators or conveyor belts. Consider the greater use of hand tools rather than power tools.
Related to lifestyle	Rearrange lifestyles, individually or as a group, so as to reduce the amount of energy required. Consider using more energy-efficient modes of transport.
Related to transport	Consider using more energy-efficient modes of transport or more energy-efficient devices of the same mode. For example, consider walking rather than using a car. Optimize the use of freight capacity, taking account of both outward and inward legs as applicable. Consider pooling transport resources.

Energy efficiency improvement measures by sector

Sometimes it is useful to think about energy efficiency improvement measures by sector rather than by whether they are technological or people-based. Here again the EU Directives can help. For example, Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC – often referred to as the 'Energy Services Directive (ESD)' – has a very useful annex (Annex III) which remains in force and which gives a good overview of measures by sector. Table 15 presents the information from Annex III of the ESD.

Table 15: Examples of energy efficiency improvement measures by sector

Sector	Measure
Residential and tertiary sectors	Heating and cooling (e.g. heat pumps, new efficient boilers, installation/efficient update of district heating/cooling systems). Insulation and ventilation (e.g. wall cavity and roof insulation, double/triple glazing of windows, passive heating and cooling). Hot water (e.g. installation of new devices, direct and efficient use in space heating, washing machines). Lighting (e.g. new efficient bulbs and ballasts, digital control systems, use of motion detectors for lighting systems in commercial buildings). Cooking and refrigeration (e.g. new efficient devices, heat recovery systems). Other equipment and appliances (e.g. combined heat and power appliances, new efficient devices, time control for

Sector	Measure
	optimized energy use, stand-by loss reduction, installation of capacitors to reduce reactive power, transformers with low losses). Domestic generation of renewable energy sources, whereby the amount of purchased energy is reduced (e.g. solar thermal applications, domestic hot water, solar-assisted space heating and cooling).
Industry sector	Product manufacturing processes (e.g. more efficient use of compressed air, condensate and switches and valves, use of automatic and integrated systems, efficient stand-by modes). Motors and drives (e.g. increase in the use of electronic controls, variable-speed drives, integrated application programming, frequency conversion, electrical motors with high efficiency). Fans, variable-speed drives and ventilation (e.g. new devices/systems, use of natural ventilation). Demand-response management (e.g. load management, peak-shaving control systems). High-efficiency cogeneration (e.g. combined heat and power appliances).
Transport sector	Mode of travel used (e.g. promotion of energy-efficient vehicles, energy-efficient use of vehicles, including tyre pressure adjustment schemes, energy efficiency devices and add-on devices for vehicles, fuel additives which improve energy efficiency, high-lubricity oils and low-resistance tyres). Modal shifts of travel (e.g. car-free home–office transportation arrangements, car sharing, modal shifts from more energy-consuming modes of transport to less energy-consuming ones, per passenger-km or tonne-km). Car-free days.
Cross-sectoral measures	Standards and norms that aim primarily at improving the energy efficiency of products and services, including buildings. Energy-labelling schemes. Metering, intelligent metering systems such as individual metering instruments managed remotely, and informative billing. Training and education that lead to the application of energy-efficient technology and/or techniques.
Horizontal measures	Regulations, taxes etc. that have the effect of reducing energy end-use consumption. Focused information campaigns that promote energy efficiency improvement and energy-efficiency improvement measures.

Putting it all together

We started this chapter by explaining that ISO 50001 does not use the term 'energy conservation'. Instead it uses the concept of 'energy performance' and requires that energy performance be improved. We then went on to explain that within the EU, the concept of 'energy efficiency improvement' is fundamental for anybody involved in energy management. Although ISO 50001 uses the term 'energy performance', any of the energy efficiency improvement measures highlighted above would both satisfy the requirements of the latest EU EED and those of ISO 50001. So if you are a non-energy professional, please use the tables above to give you some idea of the kind of energy efficiency improvements that might be available to your organization.

Chapter 10 – Energy performance

Introduction

What follows is probably one of the most important chapters of this book, because it focuses entirely on one thing, which is the concept of 'energy performance'.

There are many references to energy performance in ISO 50001. But here is one that sums up the importance of energy performance to you.

> – is effectively implemented and maintained, and improves energy performance.
>
> Source: ISO 50001:2011, 4.6.3, 1st paragraph, final bullet (our underlining)

This one sentence sums up everything that is required from anybody looking to implement ISO 50001: you have to implement it, maintain it and you have to demonstrate that by so doing you improve your energy performance. So it is probably well worthwhile making sure that you understand what energy performance is.

Energy performance defined

By now you will be very used to our insistence that you understand how terms are defined within ISO and of course particularly in relation to ISO 50001. If you think that we are overdoing this, then please allow us to remind you that all of the third-party auditors that might audit your implementation of ISO 50001 will know exactly how these terms are defined, so it seems to us that you should too.

To help ensure that you do understand, we are going to demonstrate how the principle of substitution that we talked about way back in Chapter 2 should be applied to the concept of energy performance.

Let us start with four definitions taken from ISO 50001:

> 3.12
> **energy performance**
> measurable results related to **energy efficiency** (3.8), **energy use** (3.18) and **energy consumption** (3.7)

NOTE 1 In the context of energy management systems, results can be measured against the organization's energy policy, objectives, targets and other energy performance requirements.

NOTE 2 Energy performance is one component of the performance of the energy management system.

3.8
energy efficiency
ratio or other quantitative relationship between an output of performance, service, goods or energy, and an input of energy

EXAMPLE Conversion efficiency; energy required/energy used; output/input; theoretical energy used to operate/energy used to operate.

NOTE Both input and output need to be clearly specified in quantity and quality, and be measurable.

3.18
energy use
manner or kind of application of energy

EXAMPLE Ventilation; lighting; heating; cooling; transportation; processes; production lines.

3.7
energy consumption
quantity of energy applied

Source: ISO 50001:2011

Energy performance taken apart

Now comes the rather messy bit of the process, which is to show the effect of the principle of substitution. Let us start by doing simply that.

Step 1: Write down the definition for **energy performance**.

> 'measurable results related to **energy efficiency**, **energy use** and **energy consumption**'

Step 2: Write down the definition for **energy efficiency**.

> 'ratio or other quantitative relationship between an output of performance, service, goods or energy, and an input of energy'

Step 3: Substitute the term **energy efficiency** in the definition of **energy performance** with the definition of **energy efficiency**

> 'measurable results related to *(a) ratio or other quantitative relationship between an output of performance, service, goods or energy, and an input of energy*, **energy use** and **energy consumption**'

Step 4: Do the same thing for the terms **energy use** and **energy consumption**

> 'measurable results related to (a) ratio or other quantitative relationship between an output of performance, service, goods or energy, and an input of energy, (b) manner or kind of application of energy and (c) quantity of energy applied'

So the final result is:

> Measurable results related to the ratio or other quantitative relationship between an output of performance, service, goods or energy, and an input of energy; or
> Measurable results related to the manner or kind of application of energy; or
> Measurable results related to a quantity of energy applied.

You can see that we have broken the final statement down to make it clear that there are alternatives – that there is a need to recognize *or* as well as *and*. In other words, the intent here is *not* that you have to show an improvement in energy efficiency *and* energy use *and* energy consumption in order to satisfy the requirement that there has been an improvement in energy performance.

Obviously any organization that can show an improvement in all of these things will stand to make the most gain from implementing ISO 50001. But sometimes an improvement in one may not lead to an improvement in another.

For example, consider the case where it is decided to use a so-called renewable energy source (such as a wind generator) to provide electricity for a particular process or facility or any other entity that you have defined. It may well be that the overall energy efficiency for this bounded entity (something that is in your Scope and for which you have defined its boundary) goes down rather than up, because you may have to put in place measures to cope, for example, with intermittent supply. (By the way, note that we have not mentioned here anything to do with carbon reduction. It is very often the case that an improvement in energy performance will result in a reduced carbon footprint – especially if the opportunity is used to capture energy that would otherwise be wasted – but ISO 50001 is about improving energy performance as defined in the standard, and it is this that should be your primary focus.)

So, is this an improvement in energy performance or not? The answer is that it all depends! If, in your energy policy, you have set an energy objective to increase the proportion of energy that you consume from renewable energy sources, and if this switch to a wind generator means that you have increased this proportion, then yes: you have improved your energy performance.

Here is another example. Say that you want to reduce the energy consumption for a bounded entity, and say that this bounded entity is a small office block. You might achieve your goal by replacing a variety of energy-using devices (such as lamps, heating devices, cooling devices, and so on) with ones that are intrinsically more efficient. Here again, if you have an energy objective to achieve this reduction in energy consumption with no other caveats, then of course you have improved your energy performance. But what about the energy used to implement the change? Should that be counted? If this had been part of the energy objective then clearly the answer is Yes. But we said that there were no other caveats, so the answer is No. Take care when agreeing your objectives! And what about if the same reduction in consumption could have been achieved by some simple change to office working practice, even something as simple as changing working hours in order to gain maximum advantage of daylight, or shutting down parts of the office block that are not being used, or even just turning off the lights when you go home?

Using energy performance to your advantage

As you plan and implement ISO 50001, we urge you to make maximum use of the concept of 'energy performance'. If you do, we are confident that the answers to what at first appear to be rather difficult questions become much easier. This final part of the chapter helps you understand some of the things that you can do to make life easier for yourself.

Obtain top management support

Firstly, getting top management support is a vital part of any project, including implementing ISO 50001. Spend as much time as you can with top management, or as much time as they will give you, to discuss and agree why you are implementing ISO 50001. This is really important, because it will impact on everything else. For example, make sure that you are ruthlessly realistic. Choose a scope, and define your boundaries carefully. It is better to start off with a simple scope and perhaps just one or two bounded entities than it is to believe that you can achieve everything in one go. Work very hard to dovetail the resultant energy policy with top management's overall strategy.

For example, if corporate responsibility is very important to top management, then it might be that a focus on energy use (in the sense of the sourcing of energy) and objectives related to increasing the proportion of energy sourced from renewable supplies is more important than overall energy consumption. On the other hand, if improving the bottom line is the overriding strategy, then energy efficiency and energy consumption are likely to be more important. The more that you can

Chapter 11 – Measurement

Introduction

Many people are used to the old proverb 'if you cannot measure it, you cannot manage it'. This is certainly true of ISO 50001! In fact, measurement is at the heart of all of the ISO management system standards (MSSs).

This chapter does not set out to be a textbook on measurement. Rather it sets out some of the fundamental principles behind the concept of measurement and then relates these to things of special relevance to ISO 50001, such as baselines and energy performance indicators (EnPIs).

Part C of this book pays particular attention to measurement, and it is there that you will find specific guidance related to particular parts of ISO 50001.

What is measurement?

This may seem a strange question to pose, because we all know what measurement is – do we not? Perhaps we do, but because so much depends on measurement, forgive us if we take a few moments to go back to some first principles.

The first thing to remember is that the word 'measurement' is a noun and only a noun. It describes either the action of measuring or the results of that action. So when you see the word 'measurement', take care to understand whether it is talking about the action or the result. For example, when you measure something you get a measurement. Those measurements become the data which inform many decisions. However, the process of measuring something can also be called measurement.

In contrast, the word 'measure' can be either a noun or a verb. In the context of ISO 50001, measure is used most often as a verb. However, even when used as a verb, two options are available, as highlighted by these two definitions:

> **measure**, verb
> 3 Ascertain or determine the spatial magnitude or quantity of (something), ascertain or determine (a spatial magnitude or quantity), by the application of some object of

valuable resource that we call energy as well as possible. Sometimes an improvement in one area can lead to undesirable consequences in another area, but if on balance the improvement outweighs the undesirable consequences, then it should be carried out. What is really important is that you are able to demonstrate to yourself, to your top management (and that, of course, might be yourself) and (if you are going to ask for certification) third-party auditors that you have thought through and recorded the reasons why you have decided that your significant energy use is what it is.

Note: We are confident that it will not have escaped your notice that if you have followed the process approach described in Chapter 8, then the fact that you will know what processes are involved within your scope and boundaries will make it much easier for you to decide on what your significant energy use is.

Agree and record your energy objective(s)

Be sure to take everything that we have discussed above into account when you agree and then record your energy objective(s).

> 3.11
> **energy objective**
> specified outcome or achievement set to meet the organization's energy policy related to improved energy performance
>
> Source: ISO 50001:2011

The words 'outcome' and 'achievement' might seem to be two sides of the same coin. However, the intent was to indicate that an 'outcome' might well be a quantitative value, whereas an 'achievement' might well be a qualitative value. The more time you spend on ensuring that your 'energy objective(s)' are well defined, aligned with top management strategy, and can be measured, then the greater your chance of success in achieving your aim of improving energy performance.

Understand and make effective use of energy performance indicators

Finally, understand and make effective use of EnPIs. We talk about EnPIs in the next chapter, so please be sure to take note.

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> **measure**, verb
> 3 Ascertain or determine the spatial magnitude or quantity of (something), ascertain or determine (a spatial magnitude or quantity), by the application of some object of

known size or capacity or by comparison with some fixed unit. 4 Estimate the amount, duration, value, etc., of (an abstract thing) by comparison with some standard; judge or estimate the greatness or value of (a person, a quality, etc.) by a certain standard or rule; appraise by comparison with something else.

Source: *Shorter Oxford English Dictionary, Fifth Edition*

You could conveniently say that the first definition relates to things that are quantitative and the second definition relates to things that are qualitative. In the majority of cases, ISO 50001 is referring to quantitative data, but not always. For example, the measurement of competency can often involve qualitative as well as quantitative data.

However, there is one common element between both definitions: both of them make it clear that when you measure something you compare it with something else, and that this 'something else' is a point of reference. In other words, measurement depends upon an agreed point of reference.

Points of reference

Points of reference are another example of matryoshka dolls or of cascading style sheets: one point of reference depends on another point of reference that depends on another, and so on. Perhaps the most fundamental use of points of reference is that made by the Bureau International des Poids et Mesures (BIPM) in defining the constant points of reference used by the seven SI base units.

We make this point because it is sometimes easy to lose sight of the fact that something as familiar as kilowatt-hour is only meaningful because of the use of points of reference such as length, time and mass. And then, of course, each of these has its own particular point of reference, such as this:

unit of time (second)
The second is the duration of 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium 133 atom.

Source: *The International System of Units (SI)*, Eighth Edition (2006), 2.1.1.3

This is a very exact specification of the point of reference used for taking a measure of time. It allows us to have confidence that when we make the comparison referred to by the *Shorter Oxford English Dictionary* definitions quoted above, we know that 20 seconds is a measurement of time that indicates that 20 seconds' elapsed time is longer than 10 seconds' elapsed time. We know this because both measurements have a common point of reference: they have the same baseline.

Because we have confidence in these two measurements, we can also have greater confidence in any decisions that use them. For example, if we want to assert that object *x* has a speed that is greater than that of object *y*, we can be confident that if *x* has a speed of 50 km/h and *y* has a speed of 25 km/h, then *x* has a greater speed than *y*. We know this because we are confident in the baseline that is being used for time and also in that being used for length.

If we wanted to be super specific, we could specify not just the measurements, but also the point of reference on which the measurement was based. For example, we could say something such as:

> *x* has a speed of 25 km/h, where this measurement is characterized by the fact that the unit of time is based on the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium 133 atom and the fact that the unit of length is characterized by the length of the path travelled by light in a vacuum during a time interval of 1/299,792,458 of a second. (As based on the definitions from the (BIPM).)

By now, you are probably wondering why we are going to such lengths to explain the importance of points of reference. Please bear with us, because points of reference are at the heart of two very important concepts required for a successful implementation of ISO 50001: baselines and performance indicators.

First we need to talk again about the term 'characteristic', which we first came across Chapter 1 and defined in Chapter 7, see page 49.

The importance of characteristics

A couple of paragraphs ago we introduced the term 'characterized'. The term 'characteristic' appears frequently within ISO standards. This is because characterization is a very convenient way of distinguishing one thing from another. For example, you can say that this thing is chemical because it has the following characteristics, but that another thing is biological because it has these different characteristics. We use characterization (knowingly or unknowingly) all of the time.

Here is the formal definition of the term 'characteristic':

> 3.5.1
> **characteristic**
> distinguishing feature
>
> NOTE 1 A characteristic can be inherent or assigned.
>
> NOTE 2 A characteristic can be qualitative or quantitative.

NOTE 3 There are various classes of characteristic, such as the following:

- physical (e.g. mechanical, electrical, chemical or biological characteristics);
- sensory (e.g. related to smell, touch, taste, sight, hearing);
- behavioral (e.g. courtesy, honesty, veracity);
- temporal (e.g. punctuality, reliability, availability);
- ergonomic (e.g. physiological characteristic, or related to human safety);
- functional (e.g. maximum speed of an aircraft).

Source: ISO 9000:2005, 3.5.1

Why is this important to an implementation of ISO 50001? Well, by now you will have seen many instances of where ISO 50001 requires an exact description of something. (And this is true of every other ISO standard.) For example, in Chapter 7 we gave some pretty extensive advice on how to mark up a controlled document (covered by bullet c) of 4.5.4.2 of ISO 50001):

c) ensure that changes and the current revision status of documents are identified;

The intent here is that all controlled documents should have on them (in analogue or digital form) sufficient detail such that their status can be easily identified. The following details should suffice:

- A unique identifier for each document. This does not need to be complicated; a simple incremental numeric number will do.
- A date indicator.
- A revision indicator. Again this can be quite simple, such as 'Rev. A' or 'Rev 001'.
- A status indicator. It is useful to think about the flow of the process by which a document is either created or revised. A detailed flow might go along the lines of: working draft(s); draft for comment; draft for agreement; issued; withdrawn; archived. You may not need all of the stages, but do make sure that the status of each document is clearly stated on the document, and remember that each document will need a unique identifier.
- An 'origin' indicator(s). Normally the information includes: the originating department; the originator; the originator's manager; the approving manager (where the originator or the originator's manager is not authorized to approve the document).

We could also have given the same advice, but in terms of characterization:

Produce documents characterized by the fact that they have:

- A unique identifier.
- A date indicator.
- A revision indicator.
- A status indicator.

- An 'origin' indicator(s).

So the importance of characteristics is that they can be used to uniquely identify a thing or a combination of things. Now let us see how the concept of characteristics can be applied very effectively to baselines and performance indicators.

Baselines

Here is the definition for an energy baseline:

> 3.6
> **energy baseline**
> quantitative reference(s) providing a basis for comparison of energy performance
>
> NOTE 1 An energy baseline reflects a specified period of time.
>
> NOTE 2 An energy baseline can be normalized using variables which affect energy use and/or consumption, e.g. production level, degree days (outdoor temperature), etc.
>
> NOTE 3 The energy baseline is also used for calculation of energy savings, as a reference before and after implementation of energy performance improvement actions.
>
> Source: ISO 50001:2011

You can see that this is something to do with quantitative measurement because: (a) it uses the term 'quantitative'; (b) it also uses the term 'reference'; and (c) it also uses the term 'comparison'. So a baseline is simply a reference against which you can compare one measurement with another measurement.

We are entering dangerous territory by using the phrase 'simply', because many energy professionals will explain that establishing a baseline is a very complicated thing to do. Sometimes this is indeed the case, but sometimes it is not. It really does depend (yet again) on the scope and boundaries of your energy management system (EnMS).

One of the things that will affect the complexity of establishing a baseline is the number of characteristics that you need to take into account. ISO 50001 has already stipulated one of these characteristics, because the definition of a baseline includes the note that: 'An energy baseline reflects a specified period of time'. Expressed in terms of characteristics, we might say:

> This baseline is characterized by the fact that it covers a specified period of time, and this specified period of time is characterized by the fact that it has a beginning date stamp (or date/time stamp) and an ending date stamp (or date/time stamp).

Other characteristics will be driven by decisions that you have already made regarding the characteristics of your entire EnMS, such as scope and boundaries, energy performance and significant energy. For example:

- This baseline is characterized by the fact that the data that it contains relates only to building number 23, location A.
- This baseline is characterized by the fact that the data that it contains relates only to the energy consumption of building number 23, location A.
- This baseline is characterized by the fact that the data that it contains relates only to the energy uses of building number 23, location A.
- This baseline is characterized by the fact that the data that it contains relates only to the energy efficiency of the particle accelerator (Asset ID ###) housed in building number 23, location A.
- This baseline is characterized by the fact that the data that it contains relates only to the energy efficiency of the milking parlour used by Bluebell Farm.

You can also use the concept of characteristics to explain what units you are using in a baseline. For example:

> This baseline is characterized by the fact that it uses SI units of measurement.

This may seem like a remarkably obvious thing to include, but please do not forget to specify the system of units. It is amazing how many mishaps have occurred as a result of not specifying this.

Then again, you can use characteristics to specify the accuracy with which measurements have been taken. For example:

- This baseline is characterized by the fact that all measurements have been rounded up/down to ## decimal places.
- This baseline is characterized by the fact that the instruments used to measure electrical wattage have been calibrated to [then insert whatever standard may be applicable].

Now, of course, you do not have to keep on using the phrase 'this thing is characterized by'. It is much easier to create a matrix in which you can conveniently record all of the characteristics relating to a particular baseline. Also, remember that your first baseline is likely to be the output from the first energy review.

Energy performance indicators

We are sure that you would be disappointed if we did not start off this section by reminding you how ISO 50001 defines an energy performance indicator (EnPI), so here it is:

> 3.13
> **energy performance indicator**
> **EnPI**
> quantitative value or measure of energy performance, as defined by the organization
>
> NOTE EnPIs could be expressed as a simple metric, ratio or a more complex model.
>
> Source: ISO 50001:2011

We would like to bring to your attention a couple of things.

Firstly, a value or measure is not by itself an indicator of a change in energy performance, even if you have called it an EnPI. In order to identify a change, you must be able to compare one measurement with another measurement and very likely with either a baseline measurement of the same EnPI or with a benchmark. (A benchmark is a particular kind of point of reference.)

Secondly, note that EnPIs are defined by you. But remember: they do have to relate to your EnMS as defined by you in your energy policy. EnPIs need to be relevant and you need to demonstrate that they are relevant. Using your energy policy is one way of ensuring that EnPIs are relevant. For example, there is nothing to stop you recording the results of your identification of significant energy use and then the characteristics of the related EnPIs in your energy policy. If you do this, it will probably make it easier for you to make sure that everything is lined up. EnPIs are not exactly the free for all that they might at first appear to be!

You may come across conflicting views on what makes a good or a bad EnPI. Our view is that provided it measures something that is of use to you and that is going to help you spot where you can improve your energy performance (and, as we said above, the best way to ensure this is always to align your EnPIs with your energy policy), then it is certainly fit for purpose. Our experience is that most EnPIs are indeed the ratios – and their derivatives – that the definition refers to. So let us talk briefly about ratios.

Ratios are one quantity[10] expressed in relation to another quantity by dividing the one quantity by the other, where both quantities are of the

[10] Throughout this book, we use the term 'quantity' as defined by ISO: 'property of a phenomenon, body, or substance, where the property has a magnitude that can be expressed by means of a number and a reference' Source: ISO 80000-1:2009, *Quantities and units – Part 1: General*, 3.1.

same kind. A good example of a ratio is that of energy efficiency, where an output of energy is divided by input of energy. Often the resultant number is expressed as a percentage.

A special type of ratio is a rate. Rates are used to compare different kinds of quantities. Many EnPIs do indeed compare different kinds of quantities, and are thus rates. Here are some examples:

- Energy per square metre;
- Energy per inhabitant;
- Number of wind generators per facility;
- Energy per cow.

You can also have ratios as part of a rate. What do we mean? Well for example:

- Energy efficiency (which as we have seen is a ratio) per machine;
- Energy efficiency per head.

Intensity and density

We already indicated that there is discussion within the energy community concerning EnPIs. Much of this seems to revolve around terms such as 'energy intensity' or 'energy density'. Our view is that the essential difference between these two terms is this:

- 'Energy intensity' is related to the amount of energy required to produce a given economic product or service. Examples might be the amount of energy used to heat or cool a certain living space, or to transport a person over a certain distance. Also, the energy gross domestic product (GDP) ratio is commonly used as an indicator of the energy intensity of an entire economy.
- 'Energy density' is related to the energy that can be obtained from an energy store by combustion, electrical output, heat transfer and so on. It is a statement of the energy content of a fuel or energy storage device, normally per unit mass or volume.

A good use for the PDCA cycle

It is worth taking time to ensure that your EnPIs are of real value to you and that they are relevant to you. A good way of achieving this is to use the Plan, Do, Check, Act (PDCA) cycle. Table 16 gives you some ideas on how to do this.

Plan	Decide what EnPIs best satisfy the needs of your energy policy. Write down the characteristics of each EnPI (remembering to include basic things such as how you will measure them, what units you will use for the measurement, whether you will use instruments, and, if you are using instruments, whether they need a calibration, and so on). Decide what your data collection plan will be: what data will you record, how often, and in what format? Decide whether the formal use of statistical techniques such as 'design of experiments' is needed, and if so design the experiment. Remember that such an experiment might be as simple as deciding to compare your results with those of a benchmark.
Do	Start taking your measures and record them according to your data collection plan (which is also, of course, part of a designed experiment).
Check (Study)	Study your data. We know this sounds very simplistic, but the important thing is to see whether the data 'make sense'. Sometimes this becomes immediately apparent, or sometimes you might need to check your measure against a benchmark. Sometimes you may have to go through statistical techniques, especially if in the planning phase you decided on a statistical 'experiment'.
Act	If all is well, then implement the EnPI. If all is not well, then decide what you need to do to put things right (which often can be the start of another PDCA cycle).

Table 16: Using the PDCA cycle to establish EnPIs

If you do use the PDCA cycle, please make sure that during your planning you remember to refer to any of the legislation or regulations that might affect you. Do pay particular attention to this, because you will frequently find that such legislation or regulations exactly define the EnPIs that you must use, and these definitions may use terms that we all think we understand, but which are different in the context of law.

Let us give you an example. Here is an extract from a European Union regulation (which means that it is law):

> (c) 'power' means the total installed engine power of vessels in kilowatt, measured in accordance with Council Regulation (EEC) No 2930/86, of 22 September 1986, defining characteristics for fishing vessels
>
> Source: Council Regulation (EC) No 2347/2002

You can see that 'power' has a very specific meaning if you are a fisherman!

Here is another extract from the same regulation:

(e) 'kilowatt-fishing days' means the product of the power as defined in (c) and the number of days in which a fishing vessel has any item of fishing gear deployed in the water

Source: Council Regulation (EC) No 2347/2002

If you are a fisherman, do not forget to think about 'kilowatt-fishing days' when you are planning your EnPIs!

Apples and pears

We are almost done with measurement, but before we finish we need to talk about apples and pears. One of the most important things in measurement is to make sure that you are comparing apples with apples, as the saying goes. There are many technical books available on how to ensure that apples are apples. However, put simply, the goal is to make sure that when you want to compare a measure of two quantities of the same kind (for example power), then you must make sure that either:

- The circumstances in which one measure was taken are physically exactly the same as the circumstances in which the other measure was taken. Or:
- If the circumstances in which one measure was taken are not physically exactly the same as the circumstances in which the other measure was taken, you make suitable allowances (adjustments or corrections) so as to simulate a situation where the physical circumstances were the same.

Perhaps the most well-known example of this second option is the need to make suitable allowances for the impact of ambient temperature. Every budding statistician knows that the sales of ice cream on a hot summer's day are likely to be greater than on a cold winter's day.

A good way in which to remind yourself to make the necessary allowances is simply to write down the characteristics of the circumstances in which one measure was taken, then those of the circumstances in which the second measure was taken, and compare the characteristics. You will be able to see the differences and apply the most appropriate techniques in order to make suitable allowances. We use the word 'suitable' to indicate that sometimes it is not necessary to apply hugely complex statistical analysis.

As we have said so many times before, make sure that you have written down and can discuss the rationale that you used when making sure that apples are apples.

And finally

In the Preface we said this:

> As you will learn later on, the 'size and complexity' of your implementation of ISO 50001 is entirely up to you. If you choose to make it a large, complicated implementation then unsurprisingly it is likely that it may be more expensive and create more documentation than if you choose to start with something rather smaller, succeed at that, and then decide to build on your success. We cannot emphasize this enough.

Well, exactly the same thing applies to the more technical aspects of implementing ISO 50001, discussed in Parts B and C. There is no 'one size fits all'. For example, not everybody has or can afford high-grade kilowatt-hour metering devices. But metering does not need to be this expensive. Writing down on a piece of paper how often people turn on and off appliances and then using that as a baseline for improvement can have a significant impact upon your energy performance (and yes, that also counts as metering). It is sometimes better to start off with something simple than not to start at all.

Part C – Implementing ISO 50001

Chapter 12 – How to use Part C

Context

In the introduction to our book we explained that our aim was to produce something that is of use to readers who have never implemented an ISO management systems standard before, let alone an energy management system (EnMS), but also to give clear guidance to those who have. This is why we split the book into three parts.

To remind you, Part A is about understanding ISO standards themselves. It guides you through the ins and outs of ISO standards, how to read them properly, how to comply with their requirements and so on. If you have never implemented a standard before and have turned immediately to here – Part C – then we strongly urge you to go back and read Part A.

Part B gives guidance on three important technical areas, an understanding of which will greatly help anybody who is implementing ISO 50001. If you have never implemented an EnMS before and have turned immediately to here – Part C – then, again, we strongly urge you to go back and read Part B.

If you have experience in implementing an ISO-based management systems standard, and do understand about some of the principles behind energy management, then we hope that you now enjoy Part C.

This part does not give specific templates to meet the requirements of ISO 50001. We believe that giving specific examples is dangerous because:

- It would give a false sense of security. Giving specific templates could lead organizations to assume that completing a template well and copying best practices can ensure compliance with and successful certification to ISO 50001. Applying insight of ISO 50001 and choosing available techniques that best fit the context of your organization creates the best value.
- Any tools and techniques a company chooses to use in an EnMS have to complement and integrate with any existing organizational practices, processes and systems. Tools which do not form part of day-to-day use and integrate into day-to-day practice tend to be ignored and forgotten.

- Certification auditors accept many forms of evidence. To give one or two templates prejudices the other acceptable methods of implementing a fully functional and auditable EnMS.

As mentioned earlier, many forms of evidence are acceptable. Regardless of which method is chosen to present the evidence, all methods, when used without understanding and insight, knowingly or unknowingly, are subject to misuse and poor interpretation.

An organization needs to choose methods that are appropriate for it, use them with insight, understand the assumptions in using the methods, understand the methods' advantages and disadvantages, and use the chosen methods consistently and transparently.

Therefore, instead of providing templates, this book gives a range of tools and techniques that could be deployed by an organization to support its EnMS.

We have tried our best to make Part C stand in its own right, and have provided extensive cross-references to and extracts from ISO 50001.

Part C is written on the assumption that you are familiar with or have access to a copy of ISO 50001:2011, *Energy management systems – requirements with guidance for use*. To gain maximum value while you read this book, it may be best to review the relevant clauses at the same time.

As you read through this book, one thing you will begin to notice is that there are several cyclical clauses in the standard. This is most apparent in, but not limited to, subclause 4.1 through to subclause 4.3.

For example, subclauses 4.1, 4.2 and 4.3 require an organization to show commitment to improving energy performance and an EnMS. However, the actions to improve energy performance and an EnMS are located in subclauses 4.4 and 4.5. This reflects the closed-loop nature of the Shewhart/Deming and the PDCA cycles.

The cyclical clauses also form what management system standard (MSS) auditors describe as 'a choice of audit trails'. This means that when dealing with such cyclical clauses, an MSS auditor can choose to interview the Managing Director about conformity with some of the policy or general clauses, and then to visit other people to 'drill down' into more specific clauses. Of course an auditor can also choose to visit any of the locations that you have included in the scope of your energy policy.

Navigating Part C

Part C contains a lot of detail. To help you find your way around, we have followed a consistent structure so that similar information is always

found in the same place. So each clause has its own heading followed by up to six subheadings, as shown here:

- What does ISO 50001 say?
- What does ISO 50001 mean?
- Related terms and definitions
- Related clauses
- Evidence
- FAQs.

The purpose of each of these subheadings is explained below.

What does ISO 50001 say?

The text under this heading provides a selection from ISO 50001. Some of the words or phrases are underlined to identify the key words in the clause.

Some clauses are split over several parts to facilitate easy explanation. Where this is done, the relevant clause is split into easily identifiable parts, for example Part A, Part B, and so on.

What does ISO 50001 mean?

Under this heading, the intent of the clause and how to interpret the requirements of the clause are explained.

Related term(s) and definition(s)

This section gives the terms and definitions related to the clause.

Related clause(s)

This section gives the clause(s) related to the clause being discussed.

Evidence

This section lists the evidence necessary to meet the requirements of the clause under discussion. It uses a tabular format to list a corresponding range of tools and techniques applicable to provide the evidence required.

Evidence	Tools and techniques
This lists the evidence that is required to comply with the clause.	A range of tools and techniques an organization can use to comply with the requirements of ISO 50001. Please remember that apart from the documentation requirements that have already been covered in Part A, evidence does not always have to be formal. For example, it is quite acceptable for metering data to be recorded in a school exercise book. What is important is that the energy has been metered and that you can show that it has been.

FAQs

This section lists the questions frequently asked by organizations. This includes tips, hints and additional areas that are relevant to the long-term sustainability of the EnMS but not critical to compliance with the clause.

And finally

We need to highlight a couple of final things, and then we can begin.

First: ISO uses the terms 'clause' and a 'subclause'. A subclause includes all 'sub subclauses' and so on. So something like 4.1.1.1 is still termed a subclause even though you might say that it is really a sub sub subclause!

Second: For convenience, we have used the term 'auditor' in its most general sense to refer to anybody who might be carrying out a conformity assessment. Such people do NOT of course need to be an external or third-party auditor. It could just as well be somebody who is carrying out a self-assessment. Please refer to Chapter 5 for more detail and guidance on this.

Chapter 13 – Scope of ISO 50001

What does ISO 50001 say?

Clause 1 defines the scope of ISO 50001. We explained in Chapter 1 that it is important for you to read and understand the Scope. It does not contain any 'shall' provisions, i.e. requirements (see Table 1 on page 8), but the Scope is the overriding framework for any implementation of ISO 50001.

The Scope informs the user that the purpose of the standard is to support closed-loop management processes and systems to improve energy performance, including energy efficiency, energy use and energy consumption. It specifies the minimum criteria for an organization to establish, implement, maintain and improve an energy management system (EnMS).

The Scope also informs the user that the standard has been designed to be used independently as a stand-alone management system, but it could also be aligned and/or integrated with other management systems.

Finally, the Scope informs the user that there are many ways to use ISO 50001. These include self-evaluation, self-declaration of conformity, and certification by an external organization.

What does ISO 50001 mean?

Clause 1 states the purpose of ISO 50001. An organization choosing to use this standard is required to:

- set up an EnMS;
- ensure that the features of the EnMS conform to a minimum specification specified in Clause 4;
- continually seek to monitor and improve energy performance and the EnMS.

Subsequent clauses of the standard define the detailed requirements for an ISO 50001 compliant EnMS.

The Scope informs the organization that an EnMS can be an independent system alongside other management systems used by the business. It reminds us that an EnMS can also be integrated with other management systems such as ISO 9001 (*Quality*), ISO 14001 (*Environmental*) and

BS OHSAS 18001:2007, *Occupational health and safety management systems – Requirements* in such a manner that the organization only has and operates one management system.

Organizations may choose to self-assess and self-declare that their EnMS is compliant with ISO 50001. The EnMS can, if the organization chooses, be certified by a certification body. The decision to certify the EnMS of an organization is determined by the business needs of the organization.

Related term(s) and definition(s)

3.2 continual improvement
3.5 energy
3.8 energy efficiency
3.9 energy management system (EnMS)
3.12 energy performance
3.18 energy use
3.22 organization

Related clause(s)

4 Energy management system requirements

Evidence

Evidence	Tools and techniques
Not applicable	Not applicable

FAQs

Question 13-1: Why did you say that ISO 50001 '... specifies the minimum criteria for an organization to establish, implement, maintain and improve an EnMS when the text does not specify what these minimum criteria actually are?

Answer 13-1: ISO standards are used all over the world by organizations of different size, maturity and complexity. The international panel of experts involved with ISO 50001 took this into account by setting out easy-to-understand minimum requirements that apply to all of these types of organization.

For example, there is a requirement that there must be an energy policy, and that the said policy must address certain topics. But the way in which the energy policy does this, the format of it or its complexity, is not specified. This means that each organization's implementation of ISO 50001 will have a common 'thing', an energy policy, which will meet some minimum criteria, and will also be fit for purpose for that organization.

Question 13-2: Which clauses in ISO 50001 are mandatory and which are not?

Answer 13-2: In all management systems standards, clauses that are mandatory have a heading that say they are a requirement. In ISO 50001, all clauses under the main heading '4 Energy management system requirements' are mandatory to comply with ISO 50001.

ISO 50001 provides two annexes (A and B). Both of them have the word 'informative' after the annex heading. This means that these annexes provide additional information. The text does not describe mandatory requirements. An auditor may not use the text in informative annexes to assess conformity. However, an auditor may use the annexes as 'opportunities for improvements'.

Question 13-3: What do you mean by 'energy use' and 'energy efficiency'?

Answer 13-3: Both of these terms are explained in detail in Chapters 9 and 10.

Question 13-4: Why should my company adopt a management system?

Answer 13-4: A management system is a useful and powerful tool that links an organization's business strategy with the outcomes actually achieved by the organization. It is the internal, integrated processes, systems and ways of working that a business uses to convert the inputs of the business, raw materials, customer requirements, energy, and so on, into the outputs of the business. In the case of ISO 50001, it is the management system that brings forth improvements in energy performance.

The effective use of a management system:

- formalizes an agreed policy and objectives of the whole business;
- aligns the objectives and commitment of all employees;
- aligns all activities of the business towards the goals of the business;
- links the knowledge, capability and skills of the company towards the intended outcome.

Question 13-5: Do I have to account for energy use in both ISO 14001 and ISO 50001?

Answer 13-5: If your organization complies with ISO 14001, then it already acknowledges the environmental impact that is a consequence of consuming energy. However, your organization can choose to manage and minimize this impact via ISO 50001.

The difference between using ISO 14001 and ISO 50001 for managing energy is that whereas ISO 14001 covers a broad range of environmental impacts, ISO 50001 is written specifically for managing energy. The clauses specify specific tools and techniques related to energy management which are not applicable to a broader range of environmental impacts.

Question 13-6: The time spent on maintaining compliance with existing ISO standards is excessive; my organization has no time to adopt another ISO standard. Why should I bother with another one?

Answer 13-6: Any organization's primary focus should be to satisfy its stakeholders, and experience shows that the implementation of an MSS can help make this easier to achieve. If your stakeholders value energy conservation or value a reduction in costs then they will encourage the implementation of ISO 50001. If they do not, then one of the major prerequisites for the implementation of any standard, support from top management, is not fulfilled and you should not carry out the implementation.

Question 13-7: Is it necessary for my EnMS to contain all of the headings as listed in ISO 50001?

Answer 13-7: No. ISO 50001 has been structured in a logical way, and the clause headings follow this structure, therefore it does make good sense to use them as a 'checklist' for your implementation. The best way to do this is to follow the ISO 'process approach' set out in Chapter 8. However, you are free to choose any other system, but do make sure that it covers all of the topics set out in ISO 50001.

Question 13-8: Why should an organization choose to have its EnMS certified to ISO 50001 by an independent body?

Answer 13-8: This is what ISO says (and we agree with them).

> Certification of a management system provides independent demonstration that the management system of the organization:
> a) conforms to specified requirements,
> b) is capable of consistently achieving its stated policy and objectives, and
> c) is effectively implemented.
>
> Conformity assessment such as certification of a management system thereby provides value to the organization, its customers and interested parties.
>
> Source: ISO/IEC 17021:2011, Introduction

See Chapter 5 for a comprehensive review of this topic.

Chapter 14 – 4.1 General requirements

What does ISO 50001 say?

Subclause 4.1 requires an organization to:

a) establish, document, implement, maintain and improve an EnMS;
b) define and document the scope and boundaries of its EnMS;
c) determine how it will meet the requirements of this International Standard in order to achieve continual improvement of its energy performance and of its EnMS.

Source: ISO 50001:2011, 4.1

What does ISO 50001 mean?

This subclause informs the organization that in order to conform to ISO 50001, it is the responsibility of the organization to establish, document, implement, maintain and improve an EnMS. The subsequent clauses of the standard set out the specific requirements for achieving this.

In ISO 9001 (*Quality management systems*), ISO 14001 (*Environmental management systems*) and BS OHSAS 18001 (*Occupational health and safety management systems*), top management is held responsible for meeting all of the requirements. This is not the case with ISO 50001.

ISO 50001 holds the organization to be responsible for complying with the majority of the requirements. Some subclauses in ISO 50001 are specific to top management.

There are additional subclauses to describe the responsibilities of top management, management representative, and other employees in the organization.

Care should be exercised when reading the standard to ensure that requirements are carried out at the appropriate levels within the organization. When reading the standard, the key question to ask is, 'Who is responsible to implement the requirements of this subclause?' We will highlight the different levels of responsibilities, as appropriate throughout Part C.

Finally, subclause 4.1 requires the organization to continually improve its energy performance and its EnMS.

Related term(s) and definition(s)

3.1 boundaries
3.22 organization
3.26 scope
3.28 top management

Related clause(s)

4.5.4.1 Documentation requirements
4.5.4.2 Control of documents
4.6 Checking
4.7 Management review

Evidence

Evidence	Tools and techniques
The evidence for subclause 4.1 is provided by the accumulated evidence of the remaining subclauses.	Not applicable

FAQs

Question 14-1: Why is there a need to demonstrate that the EnMS itself, and energy performance are continually improving?

Answer 14-1: Although management frequently supports the need for an improvement in energy performance, sometimes the activities of managing energy performance are carried out in an ad-hoc manner, independent from management focus and attention.

When the organization's focus moves away from the activities to sustain and improve its energy performance, e.g. when there are priorities other than energy, the energy performance tends to degrade to a point when another wave of activities is launched to improve its energy performance.

At other times an external trigger – such as a change in regulations, market conditions or energy cost – highlights the need for change.

ISO 50001 combines best practice in carrying out energy performance improvements with best practice in leadership and management. It shows how proactive energy management assists in overcoming lethargy and encourages a long-term view of opportunities for improvement.

The doctrine of continual improvement also instils a discipline to continually keep abreast of developments in legal and other external requirements. This encourages the identification of entirely new opportunities or a review of opportunities that had previously been unfeasible or not necessary.

Chapter 15 – 4.2 Management responsibility

This subclause specifies the top management's responsibility and the responsibilities of a management representative. Very frequently, organizations, especially those using other ISO based management systems, tend to assume that the management responsibility is unimportant. They skip this subclause and go straight to the more technical clauses.

It is highly recommended that you do not overlook this subclause.

Some of the people-based barriers to improvements in an EnMS and in energy performance have their root cause in poorly defined responsibilities. This can happen in the normal day-to-day operation of an organization, which is why ISO emphasizes the need for properly documented processes, procedures and 'specifications' in general. It also frequently occurs when responsibility is passed from one manager to another. This can be on a temporary basis to cover things such as sickness or leave, or on a permanent basis when one manager replaces another. In either case, adequate documentation is essential: and remember that assumptions that are in your mind are no help unless you have written them down somewhere!

4.2.1 Top management

What does ISO 50001 say?

Top management shall demonstrate its commitment to support the EnMS and to continually improve its effectiveness by:

a) defining, establishing, implementing and maintaining an energy policy;
b) appointing a management representative and approving the formation of an energy management team;
c) providing the resources needed to establish, implement, maintain and improve the EnMS and the resulting energy performance;
d) identifying the scope and boundaries to be addressed by the EnMS;
e) communicating the importance of energy management to those in the organization;

f) ensuring that energy objectives and targets are established;
g) ensuring that EnPIs are appropriate to the organization;
h) considering energy performance in long-term planning;
i) ensuring that results are measured and reported at determined intervals;
j) conducting management reviews.

Source: ISO 50001:2011, 4.2.1

What does ISO 50001 mean?

The intention of subclause 4.2.1 is to secure the commitment and involvement of top management in the EnMS. It does so in two ways.

Firstly, it requires the active involvement of top management in: the creation and continual maintenance of an energy policy; appointing a management representative; approving the energy management team; providing the resources; defining the scope and boundaries of the EnMS; and in carrying out regular management reviews.

Secondly, it tasks a management representative and the energy management team with specific accountability and responsibility in creating and maintaining an EnMS and with improving energy performance. For the other bullet points listed above, top management need only ensure compliance with the requirements.

This gives top management the flexibility to be fully involved in creating the whole energy management system (EnMS) or to be involved only in tasks that require top management inputs and to delegate the rest to the management representative.

Related term(s) and definition(s)

3.1 boundaries
3.26 scope
3.28 top management

Related clause(s)

4.2.2 Management representative
4.3 Energy policy
4.4.5 Energy performance indicators
4.4.6 Energy objectives, energy targets and energy management action plans
4.5.3 Communication
4.7 Management review

Evidence

Evidence	Tools and techniques
An energy policy is available.	See Chapter 16 on Clause 4.3.
Top management played a part in creating an energy policy.	Top management (individually or as part of the team) defines, establishes, implements and continually reviews the energy policy. Some examples are: – Attendance list for an EnMS workshop where an energy policy was developed; – Minutes of a meeting when the energy policy was initially developed; – Record of an interview in which top management recounts how the energy policy was developed; – Record of a management review during which the energy policy was developed and/or revised. Note It is not acceptable for anyone within the organization or an external consultant to carry out this activity independently, and then present it to the top management for comment and approval.
Top management played a part in defining the scope and boundary of its EnMS.	Evidence that top management was part of the team defining the scope and boundary includes: – Attendance list for an EnMS workshop where the scope and boundary were developed; – Minutes of a meeting when the scope and boundary were initially defined; – Record of an interview in which top management recounts how the scope and boundary were agreed; – Other records, e.g. minutes of meeting, proposals, recommendations etc., where the scope and boundaries of the EnMS were proposed by the energy

Evidence	Tools and techniques
	manager or external consultant and accepted by top management.
The existence of a management representative for energy and an energy management team.	There is a named person or position having the responsibility of a management representative. There is a named person(s) or position(s) having the responsibility of an energy management team. See page 115 where subclause 4.2.2 is discussed.
Employees are aware of the existence of an EnMS within the organization, and understand their roles within the EnMS and the resources available to them.	See Chapter 18, where subclause 4.5.3 is discussed.
Documents pertaining to the EnPIs used in the organization, objectives, targets and action plans are available.	Top management can successfully retrieve the documents described in Chapter 17 in the sections on subclauses 4.4.5 and 4.4.6.
Top management is aware of the availability and current status of energy objectives, targets and the relevant EnPIs used in the organization.	Top management can: – describe and discuss the EnPIs used in the organization, including what they mean, who computes them and their relevance to the organization; – produce, discuss and justify (preferably by comparison to alternatives) a list of energy objectives, targets and action plans for the period in question. All of the above could also be demonstrated through intelligent conversation when an auditor is around or by reviewing minutes of meetings, etc.
Records from management review	See Chapter 20 on subclause 4.7.

Evidence	Tools and techniques
contain elements specified in subclause 4.7.	
If relevant, evidence of long-term planning to improve energy performance.	Many different types of long-term planning can be used to support this requirement. Some examples are: – Improvement plans related to energy listed in an environmental management system (EMS); – Improvement plans listed in environmental permits that relate to energy; – Corporate sustainability plans; – Corporate social responsibility plans as they relate to energy; – Design reviews of energy performance associated with relevant Capital Expenditure (CAPEX) Plans; – Listings of energy objectives, targets and action plans that span more than one year.

FAQs

Question 15-1: What is an appropriate scope and boundary for my organization?

Answer 15-1: There is no definitive answer to the question because both the scope of an EnMS and any boundaries within the scope are defined by top management. It is important to remember that although every MSS requires a written declaration of scope, ISO 50001 goes further because it also requires you to define boundaries. The scope deals with 'activities, facilities and decisions', and then boundaries delineate any 'physical or site limits and/or organizational limits' within the scope (processes often form excellent boundaries).

There can only be one scope for an implementation of ISO 50001, but there can be multiple boundaries within that scope (although top management might decide that the scope and boundary of the ISO 50001 implementation will be the same). Chapter 4 gives detailed advice regarding scope and boundaries.

Finally, remember that although top management is free to define scope and boundaries, this could be done in a manner that gives little or no opportunity to improve energy performance. This may lead an auditor to question the effectiveness of the EnMS.

Question 15-2: How do I determine what constitutes top management?

Answer 15-2: Good question. Although the definition of 'top management' seems clear, there is then this note to the definition: 'Top management controls the organization defined within the scope and boundaries of the EnMS.' Therefore, what constitutes top management is sometimes an iterative process, because an organization cannot identify top management without first identifying the scope and boundary, and vice versa. This may seem like an unresolvable dichotomy, but our experience is that the motivation for implementing ISO 50001 normally comes from one or two people who are clear as to who their top management 'sponsors' are (and may indeed be quite clearly 'top management'). What you must do is ensure that these sponsors do have authority to take decisions within the scope and boundaries being discussed at this formative stage of the implementation.

Whilst top management is free to define the scope and boundary, the scope and boundary could be defined in a manner that gives little or no opportunity to improve energy performance. This may lead an auditor to question the effectiveness of the EnMS.

Question 15-3: What constitute resources to be allocated?

Answer 15-3: While top management is required to provide adequate resources for the execution of an EnMS, ISO 50001 limits the definition of resources to human resources, specialized skills, technology and financial resourses.

Other resources that may be important include: time, information (particularly energy information), authority, space to carry out the work, and appropriate tools for the job.

Question 15-4: How does top management ensure that the EnPIs chosen and used are appropriate to the organization?

Answer 15-4: Subclause 4.2.1 does not require top management to be well versed in energy management, so they may well be unsure as to whether or not the right EnPIs have been chosen. There are several things top management can do to ensure that the EnPIs are suitable:

- Seek assurance from the management representative and/or external consultant that the EnPIs are appropriate.
- Check that data presented have a good correlation with the chosen variable and EnPIs.

- Obtain basic knowledge of data analysis and energy management at a managerial level.
- Obtain the services of an independent and suitably qualified body to verify the energy data analysis.

4.2.2 Management representative

What does ISO 50001 say?

Top management shall appoint a management representative(s) with appropriate skills and competence, who has the responsibility and authority to:

a) ensure the EnMS is established, implemented, maintained, and continually improved in accordance with this International Standard;
b) identify person(s), authorized by an appropriate level of management, to work with the management representative in support of energy management activities;
c) report to top management on energy performance;
d) report to top management on the performance of the EnMS;
e) ensure that the planning of energy management activities is designed to support the organization's energy policy;
g) determine criteria and methods needed to ensure that both the operation and control of the EnMS are effective;
h) promote awareness of the energy policy and objectives at all levels of the organization.

Source: ISO 50001:2011, 4.2.2

What does ISO 50001 mean?

Subclause 4.2.2 requires top management to identify a management representative. The management representative assumes overall responsibility for the initial implementation of an EnMS and that the organization achieves improvements in energy performance.

A detailed inspection of the bullet points will reveal that 4.2.2 requires the management representative to work with and through other people if the EnMS is to be effective and successful in bringing about an improvement in energy performance. The management representative should ensure that documents are available and complete, communicate and liaise with colleagues and employees, provide guidance, act as an interface between the top management and the energy management team, etc.

The role of an 'energy management team' is to develop the specification for the EnMS, to implement it, and to organize work that delivers an

improvement in energy performance. The work of energy management requires some energy-based technical skills.

The management representative is a management role. It does not involve technical skills to improve energy performance. Therefore, the skills, competence and authority to carry out the functions of a management representative will be different to those of an energy management team.

However, it will be an added advantage if the management representative can communicate with the team using energy management terminologies and has some basic understanding of concepts related to energy.

Related term(s) and definition(s)

3.2 continual improvement
3.3 correction
3.4 corrective action
3.9 energy management system (EnMS)
3.10 energy management team
3.23 preventive action
3.25 record

Related clause(s)

4.4 Energy planning
4.5 Implementation and operation
4.6 Checking
4.7 Management review

Evidence

Evidence	Tools and techniques
There is a named person or position designated as the management representative.	Suitable evidence is: – Top management names the person responsible for developing and maintaining an EnMS for the organization, and the person acknowledges the role; – The management representative is mentioned in the EnMS; – Organization chart or job

Evidence	Tools and techniques
	descriptions. Note 1 Some generic examples of job function include energy manager, environmental manager, corporate social responsibility director, and vice president for sustainability leadership. Note 2 It is also acceptable for the management representative to have other responsibilities within the organization.
Criteria have been specified for determining the necessary skills and competence of the management representative selected to carry out the role.	– Definition of the skills and competence of a management representative, e.g. in a job description, responsibility matrix, etc.; – Training records for the tasks to be carried out, e.g. external training in implementing ISO 50001; – Experience managing another management system that is certified by a certification body; – If the organization uses an external resource, some form of record containing the information that the external resource is skilled and competent to the same requirements as described above.
EnMS documentation and records to support its effective implementation are available.	Documentation required by subclauses 4.5.4, 4.6.3 and 4.6.5 is available and can be retrieved. Note See Chapter 18, in the section on subclause 4.5.4, and Chapter 19, in the section on subclause 4.6.3 and that on subclause 4.6.5.
If necessary, additional people are appointed and authorized to work with the management representative.	A named person(s) or position(s) responsible for developing and managing the EnMS and energy performance is available. Evidence includes: – Top management or management representative names the person responsible for implementing an

Evidence	Tools and techniques
	EnMS for the organization, and the person acknowledges the role; – The person responsible for developing and managing the EnMS and energy performance is mentioned in the EnMS; – Organization charts or job descriptions; – The use of external support, e.g. energy consultants. Note 1 If the organization uses an external resource, some form of record containing the information that the external resource is skilled and competent to the same requirements as described above. Note 2 Some generic examples of job function include energy champion, energy team, and sustainability team leader.
Demonstrate that the actions plans are aligned with energy objectives and targets and the energy policy.	The documentation required by subclause 4.3 and subclause 4.4.6 is available and can be retrieved. Note See Chapter 16 on subclause 4.3, and Chapter 17, in the section on subclause 4.4.6.
Evidence of communicating the responsibilities and authorities to the appropriate people.	Documentation to demonstrate that the requirements specified in subclause 4.5.3 have been fulfilled. Note See Chapter 18, where subclause 4.5.3 is discussed.
Criteria and methods to ensure operations and control of the EnMS is effective.	Many examples could be used to meet the requirement of this subclause. Some examples are: – Records of internal audits, any corrective actions and preventive actions, and assessment of their effectiveness; – Records of changes to energy baseline, EnPIs.; – Records of changes made to the

Evidence	Tools and techniques
	EnMS, and the reasons for them; – Schedule of meetings for tracking energy performance improvements; – Records of reviewing opportunities for improvements, or suggestions from employees; – Schedule of meetings for management reviews.

FAQs

Question 15-5: Should the management representative have the title of 'energy manager'?

Answer 15-5: There is no requirement for this management representative to be called 'energy manager'.

Question 15-6: Should the energy management team have the title of 'energy manager'?

Answer 15-6: There is no requirement for the energy management team to be called 'energy manager'. Some organizations call the energy management team the 'energy task force', 'work group', 'energy champions', 'steering committee' or the 'swat team', for example.

Question 15-7: Does the management representative have to be a member of the top management?

Answer 15-7: ISO 50001 does not require the management representative to be a member of the top management. Top management is free to appoint whoever has the skills and competence to carry out the task specified. This could be an internal employee or an external resource.

One frequent failure is for top management to give a person the responsibility of management representative who does not have the skill, competence, authority or respect of the organization's employees to execute the responsibility.

Very often, top management also has the access to information and the ability to influence the long-term success and sustainability of an EnMS and energy performance that a junior employee or external resource lacks.

The most important thing is that the management representative is given sufficient authority by top management.

Question 15-8: What is the meaning of 'skills and competence of the management representative'?

Answer 15-8: The skills and competence of the management representative are determined by the organization.

There is no requirement for the management representative to be formally qualified. However, according to the *Shorter Oxford English Dictionary*, skill is defined (inter alia) as 'Ability to do something (esp. manual or physical) well; proficiency, expertness, dexterity; an ability to do something, acquired through practice or learning' and competence as 'Power, ability, capacity, (to do, for a task etc.).' Thus it makes sense for top management to ensure that their representative has previously demonstrated the ability to 'get things done' and has sufficient understanding of both energy and management to deal 'adequately' with the implementation and maintenance of the EnMS.

Question 15-9: What is the difference between the management representative and energy management team?

Answer 15-9: There is a common misconception that the management representative is responsible for managing and improving the energy performance of an organization. The function of a management representative is to ensure that all important activities required by an EnMS are in place, and to facilitate the meetings of top management and employees.

The roles and responsibilities of the management representative do not include active involvement in improving energy performance, although many management representatives will either choose, or be required, to get involved at this level.

Question 15-10: Does the energy management team also need to be skilled and competent?

Answer 15-10: The energy management team has to be skilled and competent to carry out its function. This requirement is covered in subclause 4.5.2.

Question 15-11: How many people should be appointed to work with the management representative?

Answer 15-11: The standard does not specify how many people are necessary to work with the management representative. There might only be one person.

There is a misconception that the management representative is capable of day-to-day management of energy performance. Only in small organizations can the management representative oversee energy performance.

In medium to large organizations, the management representative cannot possibly be in every location to monitor, analyse and track every aspect of energy performance. In these organizations, the management relies on everyone within the organization to carry out their duties and responsibilities as defined in the EnMS.

In very large multi-department organizations, it is normal for a team of employees to be responsible for co-ordinating the improvements in energy performance and that of an EnMS.

As a rule of thumb, to achieve a self-sustaining momentum to continually drive any company initiative, critical mass theory suggests that at least 2–5 per cent of the employees are involved as part of their daily routine.

However, care should be taken to ensure the following:

- Each member of the team must be competent and have the authority to carry out the work requirement to improve energy performance. Very often, team members are given the responsibility but do not have the authority and resources to execute the works.
- The team must avoid making every decision by consensus. The need to reach consensus delays (or postpones indefinitely) actions.

Chapter 16 – 4.3 Energy policy

What does ISO 50001 say?

In Chapter 3 we said: '... when you decide to implement ISO 50001, you are making a public commitment to adopt a practice that is state of the art in relation to energy management'. Subclause 4.3 requires you to do this by means of an 'energy policy'. Getting this policy 'right' is one of the most important things that you will do as part of your implementation of ISO 50001.

> The energy policy shall state the organization's commitment to achieving energy performance improvement. Top management shall define the energy policy and ensure that it:
>
> a) is appropriate to the nature and scale of the organization's energy use and consumption;
> b) includes a commitment to continual improvement in energy performance;
> c) includes a commitment to ensure the availability of information and of necessary resources to achieve objectives and targets;
> d) includes a commitment to comply with applicable legal requirements and other requirements to which the organization subscribes, related to its energy use, consumption and efficiency;
> e) provides the framework for setting and reviewing energy objectives and targets;
> f) supports the purchase of energy-efficient products and services, and design for energy performance improvement;
> g) is documented and communicated at all levels within the organization;
> h) is regularly reviewed, and updated as necessary.
>
> Source: ISO 50001:2011, 4.3

What does ISO 50001 mean?

Subclause 4.3 allocates top management the responsibility to define an energy policy. This policy document records the top management's commitment and intentions to meet several best practices in energy performance. This includes setting out the guiding principles for improving energy performance in line with legal and other requirements applicable to the organization.

Related term(s) and definition(s)

3.14 energy policy
3.28 top management

Related clause(s)

4.4 Energy planning
4.5 Implementation and operation
4.6 Checking
4.7 Management review

Evidence

Evidence	Tools and techniques
The energy policy document contains information relating to subclause 4.3 bullet points (b)–(g).	– A statement by top management that it operates its business to comply with the requirements of ISO 50001. – A document with the heading 'Energy policy' containing the bullet points listed in Clause 4.3, or similar words to the same effect. – A 'policy' document combining various standards which the business subscribes to and containing the bullet points listed in Clause 4.3, or similar words to the same effect.
Communication of the energy policy to all employees and external resources working for the organization.	Records for the requirements stated in Clause 4.5.3 have been fulfilled. Note See Chapter 18, where Clause 4.5.3 is discussed.
The energy policy has been reviewed and updated following management reviews or when a major change in the organization has occurred.	– If applicable, records of revisions to the energy policy. – Revision history of the energy policy. – Old copies of the energy policy. – Minutes of meeting from a management review documenting a change in energy policy.

FAQs

Question 16-1: What is a policy document? How does it differ from a strategy document?

Answer 16-1: There can be confusion about the words 'policy' and 'strategy' because they are sometimes both used to indicate some form of 'action' or 'plan'.

In terms of a hierarchy, a policy is at a higher level than a strategy. The policy sets out an organization's overall intentions and directions and a strategy sets out how the policy is to be achieved. This is true of ISO 50001, as we explain below.

ISO 50001, subclause 3.14 defines 'energy policy' as follows: 'statement by the organization of its overall intentions and direction of an organization related to its energy performance, as formally expressed by top management'. It then goes on to say (by means of a Note): 'The energy policy provides a framework for action and for the setting of energy objectives and energy targets.'

What about strategy? Appendix B, which gives you a list of common words used in all management system standards (MSSs), defines strategy as: 'systematic plan of action to achieve an aim'. So within the context of ISO and thus ISO 50001 a policy provides the framework within which strategy is agreed.

In the context of an EnMS, your energy policy gives the overall results to be achieved and the guiding principles to achieve the overall results. The organization can then compare each of the objectives, shorter-term targets, action plans and/or improvement opportunities against the overall results to be achieved.

In theory, objectives, targets, action plans and improvement opportunities that do not contribute towards the guiding principles should receive lower priority. For more information on this, see Chapter 17, in the section on subclause 4.4.6.

Question 16-2: Does top management have to actually write the policy?

Answer 16-2: No. The energy policy can be written by the management representative or by an external consultant. An energy policy is frequently one of the deliverables from an initial review of the situation in an organization. The important point is that top management has reviewed and approved it.

Question 16-3: How does an organization demonstrate that its energy policy is appropriate to the nature and scale of its operations?

Answer 16-3: It is difficult to challenge an organization's decisions about subclause 4.3. However, our view is that a policy is appropriate to the nature and scale of the business if an organization has:

- agreed to have a EnMS in line with ISO 50001 requirements;
- had freedom to choose an appropriate scope and boundary and can justify its choices;
- identified the top management and management representative within the scope and boundary; and
- developed an energy policy.

Question 16-4: Is it necessary to have a document titled 'energy policy'? Does it need to follow the exact sequence of subclause 4.3?

Answer 16-4: No. What you *must* have is a 'statement by the organization' and it *must* be 'formally expressed by top management'. What the statement is called is up to you: but it can be convenient to give the statement the title 'The Energy Policy of ...' As such it forms part of a group of organizational documents that are sometimes called 'governance or strategic documents'.

Similarly, the structure of your statement does not have to exactly follow the sequence of the sub subclauses of subclause 4.3. What you MUST do is ensure that every requirement of 4.3 is incorporated into your statement.

Question 16-5: When should an organization develop an energy policy?

Answer 16-5: Chapter 8 gives extensive guidance on the order in which an implementation of ISO 50001 can follow. The drafting of an energy policy is shown as the fifth action, see below:

- 4.1 General requirements
- 4.2 Management responsibility
- 4.2.1 Top management
- 4.2.2 Management representative
- 4.3 Energy policy

The rationale for this is that it is helpful to have agreed your general requirements and to have decided on management responsibility before starting to write a detailed energy policy. In practice the energy policy is often drafted and redrafted several times before a final version is agreed. It is important to conscientiously review the energy policy.

Question 16-6: Should employees or contractors be required to recite the elements contained in an energy policy?

Answer 16-6: No. There are no requirements for employees and contractors to be able to recite the elements contained in an energy policy. However, subclause 4.5.2 makes it clear that there is an expectation that:

> The organization shall ensure that any person(s) working for or on its behalf are aware of:
>
> a) the importance of conformity with the energy policy, procedures and the requirements of the EnMS;
> b) their roles, responsibilities and authorities in achieving the requirements of the EnMS;
> c) ...
>
> *Source:* ISO 50001:2011, 4.5.2

A good way of achieving this, especially for larger organizations, is to produce a specific briefing pack on the EnMS and on energy performance.

Chapter 17 – 4.4 Energy planning

Subclause 4.4 contains all of the 'plan' requirements of the PDCA cycle in ISO 50001. It also contains the majority of the technical-sounding terminology. To some people, this might be off-putting, or they may feel they lack the ability to interpret the requirements, especially if they are a non-technical manager. In which case, you may be pleased to know that all of the requirements specified in subclause 4.4 are placed on the organization rather than the top management.

To help you, we will break down the clauses into bite-size chunks and simplify the explanation of these requirements. Also, be sure to spend some time reading Part B of this book which gives non-energy professionals an overview of energy efficiency, energy performance and measurement.

Our hope is to give non-energy professionals a good grounding in the requirements of subclause 4.4, but expressed in non-technical terms, sufficient for anybody to develop and put in place an EnMS that works for your organization. Of course if you need more help, then this could be sourced from external resources such as consultants and contractors. If you are an energy professional then there is little in subclause 4.3 that should cause you any difficulty.

4.4.1 General

What does ISO 50001 say?

Subclause 4.4.1 requires an organization to carry out an energy planning process. The purpose of an energy planning process is to establish a range of activities to meet the energy policy and continually improve energy performance.

This subclause also requires an organization to document the results of an energy planning process.

What does ISO 50001 mean?

Subclause 4.4.1 is an introductory subclause for the subsequent subclauses of 4.4. The standard calls the execution of the whole of subclause 4.4 an 'energy planning process', and contains the following subclauses:

- Plan and operate the business of the organization in line with all legal requirements and other requirements (4.4.2).
- Carry out an energy review (4.4.3) of the whole organization with data to identify its significant energy user, energy baselines (4.4.4) and the energy performance indicators (EnPIs) (4.4.5) associated with the significant energy users.
- Using the findings from the energy review (4.4.3), energy baselines (4.4.4) and EnPIs (4.4.5), identify opportunities that can improve energy performance.
- Based on the list of opportunities identified, plan, prioritize and mobilize resources over the short, medium and long term. In management system standard (MSS) language, this means to develop energy objectives (4.4.6), energy targets, and energy management action plans.
- Finally, all of the above activities have to be recorded and regularly reviewed in order to show that the organization is in control of its energy management system (EnMS) and is progressing to improve its energy performance.

The standard includes a diagram to show how the whole of subclause 4.4 works as a whole. This is located in the standard in Annex A, Figure A.2.

Related term(s) and definition(s)

3.6 energy baseline
3.11 energy objective
3.12 energy performance
3.15 energy review
3.27 significant energy use

Related clause(s)

4.4.2 Legal requirements and other requirements
4.4.3 Energy review
4.4.4 Energy baseline
4.4.5 Energy performance indicators
4.4.6 Energy objectives, energy targets and energy management action plans

Evidence

Evidence	Tools and techniques
Evidence that an energy planning process has been carried out.	– Copies of an initial energy planning process are available for review. – Copies of any revision to the energy planning process are available for review. Note Records of an energy planning process could be contained in one document (report, spreadsheet or presentation) or available in separate documents.
Existence of a document for carrying out an energy planning process.	The initial energy review contains the following information: – Legal requirements and other requirements; – Energy review; – Energy objectives, energy targets and energy management action plan. Note See the sections later in this chapter related to subclauses 4.4.2 to 4.4.6 for more information.

FAQs

Question 17-1: Should energy planning be carried out in one single stage?

Answer 17-1: No, it is important to remember that an energy planning process is a working process and the energy review a working document. The standard requires an organization to carry out an energy planning process and update its energy review at predefined intervals or when there is a major change in the organization.

The energy planning process and energy review may need to be reviewed more regularly when an organization is first implementing and then refining its EnMS.

Chapter 8 gives guidance on the sequence of activities for the implementation of an EnMS. Here are some further tips related specifically to energy planning.

- It is not necessary for the energy planning for all areas within the scope and boundary to be completed in one single meeting. This might be possible for a small organization, but for larger more complex organizations it is common for there to be several rounds of energy planning.
- If it appears that more than one meeting is necessary, it is beneficial to have a project plan detailing how the energy planning process will be carried out. For example, organizations may choose to give priority to one or two areas of 'significant energy use' or areas which appear to offer good opportunities to improve energy performance.
- Organizations sometimes find that they do not have all of the energy (or other...) data that may eventually be needed. In these cases it is acceptable for the organization to acknowledge this unavailability and to use less than ideal data on a temporary basis during the first rounds of analysis (for example, to use spot measurements, or monthly or weekly utility data).
- However, in these cases they should plan to improve on their data, and data analysis, at a later stage. It is important to document this planning in a manner that can be readily understood later (especially by people who may not have been involved in the first meetings).

Question 17-2: Should each round of an energy planning process result in opportunities for improving energy performance?

Answer 17-2: There are no requirements for every round of an energy planning process to identify and generate opportunities for energy performance improvement.

However, an energy planning process that continually does not generate opportunities to improve energy performance improvements could indicate that (1) there is a lack of top management commitment to improve energy performance, (2) the energy planning process used is ineffective, or (3) the skills and competency of the management representative and/or the energy management team are not appropriate for the nature and complexities of the organization.

4.4.2 Legal requirements and other requirements

What does ISO 50001 say?

Subclause 4.4.2 requires an organization to identify legal and other requirements with an impact on energy use, energy consumption and energy efficiency; to determine how these requirements apply to the organization; and to ensure that the organization always has access to them.

The subclause then requires the organization to plan and operate the business in accordance with the legal and other requirements and to review their applicability to the business at defined intervals.

What does ISO 50001 mean?

The intent of subclause 4.4.2 is to ensure that an organization understands and has continual access to copies of legal requirements and other requirements that are relevant to the operations of the organization and that have an impact on energy performance. It then requires the organization to plan its operations such that it both complies with the requirements, and is able to continually review their applicability and be aware of any changes and updates to the legal and other requirements.

This will be familiar to organizations with an existing MSS such as ISO 9001, ISO 14001 or BS 18001. Indeed these, or other management systems in place at the organization, are often a good source of information regarding legal and other requirements. If this is the case, then it is worthwhile considering a central repository of all such 'regulations'.

Related term(s) and definition(s)

3.22 organization

Related clause(s)

4.6.2 Evaluation of compliance with legal requirements and other requirements
4.6.5 Control of records

Evidence

Evidence	Tools and techniques
Have knowledge of and an ability to access the latest legal requirements and other requirements applicable to the organization (including updates).	– A procedure/methodology to identify and continually monitor for updates, e.g. to check government or other authoritative websites every quarter, to subscribe to relevant trade magazines or commercial 'registries' of regulation.

Evidence	Tools and techniques
	– A tabulated list of relevant legal and other requirements, and a note on how and where to obtain them, etc. – Copies of the legal and other requirements kept in a file. – Can demonstrate how to obtain an electronic copy of the requirements, e.g. government website, government publications office. – Can demonstrate how to access updated copies of legal and other requirements.
Demonstrate how these requirements are relevant to the business operations.	– Tabulated list of relevant legal and other requirements and notes on how they are relevant to the organization. – Reports from consultants containing the description of how the legal and other requirements apply to the business operations. – Minutes of meetings with service contractors, equipment suppliers and insurance inspectors on the applicability of relevant legal and other requirements.
Demonstrate how the organization has incorporated these requirements into the business operations.	– Ability to describe or show an auditor how the legal and other requirements are integrated into operations. – Minutes of meetings describing how legal and other requirements are or have been incorporated into operations, e.g. by means of operating procedures, work instructions, etc. – Line items in daily or weekly checklists, scheduling plans, maintenance plans, etc. – Training needs analysis, training records, etc., that show that employees have been trained to carry out specific tasks with an

Evidence	Tools and techniques
	implication for energy performance, etc.
Review and updates.	– Defined period for updates to be reviewed, e.g. reviewed every year, etc. – A list showing the history of reviews carried out on legal and other requirements. – Records of management review meetings containing updates and/or changes to legal and other requirements.

FAQs

Question 17-3: What are 'legal requirements'?

Answer 17-3: Many companies are familiar with the basic regulations applicable to the organization. Some examples are:

- Specific equipment health and safety regulations;
- Environmental regulations;
- Energy regulations;
- Industry-specific regulations, code of practice and guidance.

Question 17-4: What are 'other requirements'?

Answer 17-4: Generating the list of other requirements will require more thought. The important thing to remember is that very often these 'other requirements' are discretionary and that your organization might have chosen to comply with them. If this is the case, then as far as ISO 50001 is concerned they are just as important as legal requirements. So, for example, some of the documents under the classification of 'other requirements' could be:

- Voluntary agreements, for example climate change agreements, emissions trading, etc.;
- Raw material specification;
- Product specifications;
- Operating procedures;
- Details of product pricing and margins;
- Corporate social responsibility requirements;

– Compliance with other standards.

Question 17-5: Why is subclause 4.4.2 relevant to energy performance?

Answer 17-5: Very frequently, information on how to operate the business has been passed on via word of mouth, and the organization does not have access to the legal documents and documents that define the other requirements.

It could be that the various documents are kept and maintained by different people or different departments in the organization, and/or that the information handed down could be based on outdated documentation and understanding.

Also, although people instinctively believe that rules and regulations are increasingly restrictive, this is not always the case. For example, previous operating restrictions could have been removed because of upgraded machinery or equipment. It is always worth checking! A thorough understanding of the latest versions of legal requirements and other requirements could generate opportunities for improvement – particularly if the latest requirements are significantly different from the understood norms, operating procedures and specifications.

Finally, please don't ignore situations where the organization may not be in direct control of its destiny: e.g. where there are unmanned utilities or where the operational maintenance of energy systems has been outsourced. Opportunities for an improvement in energy performance may well exist here as well, especially if a contractor has not been made aware of any change in regulation.

Note Subclause 4.4.2 does not remove the responsibilities and duty of care of organizations regarding legal and other requirements necessary for the continued operation of the company.

4.4.3 Energy review

The concept of an 'energy review' is so important that subclause 4.4.3 is explained over four parts:

– Paragraph (1) and paragraph (2);
– Bullet point (a);
– Bullet point (b);
– Bullet point (c).

Subclause 4.4.3, paragraphs (1) and (2)

What does ISO 50001 say?

Paragraph (1) requires an organization to develop, record, maintain and update an energy review. Paragraph (2) requires the energy review to be reviewed and updated at predefined intervals or when there is a major change in facilities, equipment, systems, or processes.

Paragraph (1) also requires an organization to document the methodology and criteria used to develop the energy review.

What does ISO 50001 mean?

Subclause 4.4.3 informs the organization that in order to comply with ISO 50001, it is the responsibility of the organization to establish, document and maintain an energy review. The subsequent bullet points set out the specific requirements of an energy review. The frequency of review and update should either be 'defined' or 'when there is a major change' within the business.

Many techniques are available to prepare an energy review. Subclause 4.4.3 requires the organization to record the methodology and any criteria chosen to be used and to execute the chosen methodology and criteria in an energy review.

To show compliance with this subclause, the organization should keep records of the initial energy review and any subsequent energy reviews.

Related term(s) and definition(s)

3.15 energy review

Related clause(s)

4.4.1 General

Evidence

Evidence	Tools and techniques
Methodology for carrying out an energy review is available.	– A procedure describing every step or process the organization uses to carry out an energy review. – A statement that the organization will engage external resources to carry out an initial energy review to comply with the requirements stated in subclause 4.4.3, for example: • an energy review; • a commercial energy audit, provided that it encompasses all of the requirements of an ISO 50001 defined energy review; • an energy 'workshop'; • energy kaizen.
Criteria to identify significant energy use and to prioritize opportunities for improving energy performance are available.	– Documented criteria for how an energy use is considered to be significant. For example, this could be documented in: • an energy review; • an energy audit report; • the minutes of a meeting from the energy planning process, management review, energy policy. – Documented criteria for how opportunities will be prioritized. For example, these could be recorded in: • an energy review; • an energy audit report; • the minutes of meeting from energy planning process, management review, energy policy.
Definition of defined intervals to update energy reviews.	– Minutes of meetings indicating the next date for an energy review meeting. – Schedule of energy review meetings. – Statement in the EnMS on when an

Evidence	Tools and techniques
	energy review is to be carried out.
Records of energy review.	Records of energy reviews are available for inspection. Such records can take the form of a document, a spreadsheet or a presentation. They can be stored as either analogue or digital media (or both). Here the term 'energy reviews' incudes any revisions and updates to an energy review.

FAQs

Question 17-6: Can the energy planning process and energy review be part of the same document or procedure?

Answer 17-6: An energy review is part of energy planning and there is no reason why one document should not capture how both concepts have been implemented. But take care to ensure that all of the elements required by each concept are captured.

Question 17-7: How is an energy review different from an energy audit?

Answer 17-7: Thank you for the question! During the drafting of ISO 50001, there was considerable discussion about what the difference between the two concepts was, and whether or not the term 'energy audit' should have been used instead of 'energy review'. It seems to us that, for the purposes of an EnMS based on ISO 50001, the difference between the two concepts is as follows.

Firstly, an energy review is an ongoing, iterative process. It is the 'engine room' of the whole EnMS. It results in a 'living' document, and is iterated either at the behest of the organization, or when certain state changes occur. For example, ISO 50001 requires an iteration whenever the structure of the organization changes, or when an energy baseline or EnPI is no longer accurate. However, an energy audit, is often commissioned as a 'one-off' piece of work, and the energy auditor is normally not responsible for iterations.

Secondly, an energy review as defined by ISO 50001 includes things that are not normally included as part of an energy audit. It is seen as a larger piece of work than an energy audit, and includes an analysis of all

energy users and of all parameters that potentially might affect energy performance. These may include aspects such as:

- Over-production.
- Production speed/rate losses, yield losses, etc.
- Inventory, work in progress and storage.
- On-site transport.
- Defects, poor quality and rework.
- Over-processing.
- Production scheduling.
- Operating procedures.
- Maintenance planning.

In contrast, commercially available energy audits tend to be focused on identifying opportunities to improve energy performance in a more limited way. For example:

- They often have a fixed point of reference defined by the client.
- They often have a particular business goal in sight, such as improving 'housekeeping', or minimizing idle time or optimizing control systems.

Thirdly, a fundamental concept of a 'review' is that it compares performance against something else. For ISO 50001 that review can be against a baseline(s), or EnPIs or energy objectives. A commercial energy audit tends to present a 'snap shot' in time. This can be very useful and can form the basis for a review against the results of a previous audit: but the 'snap shots' themselves do not constitute an energy review.

There are other instances when a classic energy review is very useful. For example, it could form the basis for the initial ISO 50001 energy review: an energy audit could be carried out prior to the organization's first energy review meeting. Also, a focused energy audit can be used for a detailed analysis of opportunities highlighted by the energy review for improving the energy performance of specific equipment or a specific energy use.

You will have noticed that we have not indicated whether we think that an energy review is 'better' than an energy audit. This is because we think that in the context of ISO 50001 this is irrelevant. What is clear to us is that the energy review is seen by the standard as being a bigger, more holistic, piece of work than an energy audit. Therefore, an energy audit can usefully form part of an energy review but not vice versa.

Question 17-8: Can benchmarks be used?

Answer 17-8: Yes, it is often useful to compare energy performance using benchmarks. They are a quick and easy method to compare the

organization's chosen EnPIs with those available in the public domain or via specialist professional service firms.

Having said that, the use of benchmarking data only indicates if there is a gap between the organization's EnPIs and the benchmark EnPIs. It does very little to indicate where or what the opportunity for improvement might be. Identifying opportunities for improvement is normally the domain of an energy review.

Subclause 4.4.3, bullet point (a)

What does ISO 50001 say?

Subclause 4.4.3 requires an organization to analyse energy use and consumption based on measurement and other data. This is achieved by identifying the energy sources used by the organization and evaluating the past and present energy use and energy consumption.

What does ISO 50001 mean?

The first bullet point of subclause 4.4.3 informs the organization that the first task (because it lists this task as the first bullet point) in an energy review is to identify the energy sources used by the organization. This is an easy task of identifying the type of energy purchased by the organization, for example natural gas, liquid fuel oil, coal or electricity.

You need to identify the types of energy used by the organization. For the purposes of ISO 50001, energy incudes: 'electricity, fuels, steam, heat, compressed air, and other like media'. The standard also notes that: 'For the purposes of this International Standard, energy refers to the various forms of energy, including renewable, which can be purchased, stored, treated, used in equipment or in a process, or recovered.' Identifying energy sources that are purchased is normally an easy task. But remember to also search out any other applicable energy sources. (We say applicable, because they need to fall within your scope and boundary.)

This subclause then requires the organization to analyse its energy use and energy consumption within the identified scope and boundary of an EnMS based on measured data and other supporting data.

There are many forms of energy data analysis; these range from simple spreadsheet analysis of the trends to sophisticated statistical packages. The evidence table below gives some suggestions for acceptable energy analysis.

Related terms(s) and definition(s)

3.5 energy
3.7 energy consumption
3.18 energy use

Related clause(s)

4.6.1 Monitoring, measurement and analysis

Evidence

Evidence	Tools and techniques
Current energy sources used by the organization.	– List of energy sources, e.g. natural gas, electricity, fuel oil, coal and LPG. – Invoices from various energy suppliers. – Top management, management representative and/or energy management team are able to describe the sources of energy used within the scope and boundary of the EnMS.
Data analysis of historical energy use and energy consumption.	– Analysis of trends of meter and/or sub-meter readings recorded in a log book. – Tabular or spreadsheet analysis of historical and present energy consumption by energy source; this could be supplemented by graphs and charts. – Spreadsheet analysis of energy data available from the energy supplier or sub-meter readings. – Where energy data is not available, use of educated calculation/ rule-of-thumb estimation.

FAQs

Question 17-9: Why is data from invoices listed as acceptable evidence?

Answer 17-9: One of the most available sources of data is that contained in invoices. So it makes sense to use invoices, especially when no other sources of data are available, or when the EnMS is in its infancy. However, as with all sources of data, data from invoices can be misused or misinterpreted. Therefore, such data have to be used with insight and care.

Some of the common causes of problems are:

- The meter could be faulty.
- Some utility companies invoice based on an estimated reading.
- Different months have a different number of days.
- Different utility invoices may have different invoicing periods.

Question 17-10: Should the organization use a fixed set of energy data for analysis? If so, how much data is necessary?

Answer 17-10: To facilitate ease of data analysis, traceability and transparency, it is recommended that the organization uses the same set of energy data throughout subclause 4.4. The amount of energy data should, as a minimum, be representative of the possible patterns of energy use and consumption, within the declared scope and boundary.

Ideally, the analysis should cover 12–36 months. However, if there have been significant changes in operating patterns or changes in the installation, the organization may need to use different periods of energy data.

Question 17-11: My organization is starting out on an EnMS and does not have much energy data. What do I do?

Answer 17-11: For organizations starting out on an EnMS, some key data may not be available. It is acceptable to acknowledge this unavailability and have a commitment to obtain the data. This can be part of the metering plan covered in subclause 4.6.1.

Often organizations have access to more energy data than they might think. For example, it is possible to compute energy data using other, indirect data. Take water as an example: if an organization boils 1 kg/s of water from 15°C to 60°C using an electric kettle, the quantity of energy consumed can be calculated.

Question 17-12: Can you recommend a form of energy analysis that will help compliance with ISO 50001?

Answer 17-12: An analysis of energy data can be presented in any form as long as it is understood by the organization's employees and they can use the data presented.

Very often, the data analysis is carried out by an external resource. In which case make sure that the external resource explains what analysis has been done and how it should be used.

Capturing the energy consumption and energy cost by source can also facilitate the opportunity to find a cheaper energy supply.

Two frequently overlooked electricity cost savings are:

- Electricity demand/capacity charge: For many commercial and industrial organizations, the electricity invoice will include a line item on maximum demand or capacity charge, and an actual electricity consumption charge. If the organization consistently consumes less than the demand guaranteed for the organization, reducing this guaranteed demand can result in cost savings.
- Low-power factor penalty charge: If an organization's electricity invoice consistently contains a low-power factor penalty charge, there is an opportunity to identify the source of the low-power factor and prevent it. Sometimes, it is more cost-effective to apply power factor correction or power quality correction units.

Sometimes, cross-checking an independently metered energy source against the invoice can provide cost savings, simply by identifying metering errors.

Question 17-13: How detailed should an analysis of energy use be?

Answer 17-13: The standard does not specify the depth of energy use analysis. However, by following the principles of the standard with regards to energy management, and continuous improvement (remember the PDCA cycle), more levels of detail will bring about more opportunities to improve energy performance.

For example, in an energy review, an organization can identify the air compressor as an energy user. This is true: air compressors consume energy to produce compressed air. In some organizations, the air compressor could be the most significant energy user.

Organizations can choose to stop the energy use analysis at the air compressor. As more and more opportunities to improve the existing air compressor have been implemented, options to improve it further will diminish.

From a compressed air point of view, once the compressed air is generated, it is treated, for example dried, and distributed through pipework to its end-users. Compressed air could be treated in an inefficient air treatment plant, compressed air could leak from the distribution pipe work, or compressed air could also be used inefficiently.

By extending the energy use analysis to the very end-user of the compressed air, more opportunities for energy performance improvement can be realized. The organization could also include all other employees in controlling and improving the energy performance of the compressed air system.

As the standard does not specify the depth of the energy use analysis, an organization may choose to begin at a site level. Over subsequent energy reviews, the energy use analysis is extended to the end-users of the utility.

Subclause 4.4.3, bullet point (b)

What does ISO 50001 say?

Subclause 4.4.3 requires an organization to use the energy analysis (required by bullet point (a)) to:

- identify the significant energy use;
- identify personnel working on the significant energy use;
- identify relevant variables affecting the energy consumption of the significant energy use;
- determine the current energy performance of the significant energy use;
- estimate future energy use and consumption of the significant energy use.

What does ISO 50001 mean?

Bullet point (b) of subclause 4.4.3 informs the organization that it needs to use the energy data and analysis (carried out in bullet point (a)) to identify significant energy use.

Once this is achieved, the subclause requires the organization to:

- identify the personnel (internal or external) working on the significant energy use;
- identify the variables that will cause the energy consumption relating to the significant energy use to vary; additional data analysis and correlation may have to be carried out to verify that such correlation exists;
- determine the suitable EnPI(s) and quantify the energy performance of the significant energy use;
- estimate the future energy consumption.

The requirement of this bullet point is very closely related to subclauses 4.4.4 (energy baseline) and 4.4.5 (EnPIs). This is because an organization

would not be able to identify suitable EnPIs (4.4.5) without identifying and verifying the reasons, i.e. the variables that might cause energy consumption to vary.

We shall see later that information gained from the energy review is an important – no, a very important – source of data to inform the 'energy baseline'. For this reason we recommend that the requirements of subclauses 4.4.3, 4.4.4 and 4.4.5 are reviewed and developed in parallel and be subject to iteration.

In practice, the requirement specified by bullet point (b) of subclause 4.4.3 could be more complex compared with the rest of subclause 4.4. If you find this is the case, you may find meetings and discussions with your equipment supplier, maintenance service contractor or insurance inspector beneficial. Alternatively, the services of an external service provider could also be beneficial.

Related term(s) and definition(s)

3.7 energy consumption
3.8 energy efficiency
3.12 energy performance
3.13 energy performance indicator (EnPI)
3.18 energy use
3.27 significant energy use

Related clause(s)

4.4.4 Energy baseline
4.4.5 Energy performance indicators
4.6.1 Monitoring, measurement and analysis

Evidence

Evidence	**Tools and techniques**
The significant energy use relevant to the organization has been identified using all energy data and other data.	– A tabular list of significant energy use with reasons why the organization considers them significant energy uses. – Energy audit reports. – Graphs and charts – e.g. pie charts, Pareto analysis of energy consumption by energy users, and/or

Evidence	Tools and techniques
	Sankey diagrams – to show the large energy-consuming users as the significant energy users.
The personnel working with significant energy use have been identified.	– List of name(s) or position(s) of personnel working on the identified significant energy use, available for an auditor. – Training needs assessment or training records of personnel to show that they have been trained to work on the significant energy use. Note Very frequently, organizations only identify their employees working on areas of the significant energy use. If the organization uses external contractors to operate or maintain the significant energy use, these people also need to be included.
Justification of how the variables that cause the energy consumption to vary (within the energy data analysed) have been identified.	– Using multiple spreadsheets of energy consumption versus a variable, choose one or more variables that have a good correlation with energy consumption. – Arrange a meeting with the people working on the significant energy use to find out what may cause the energy consumption to vary. Then use energy consumption data to find which one has a good correlation. – Discuss with the equipment manufacturer what are the likely variables and plot the energy consumed versus these variables to see which ones give a good correlation. – Carry out an input–output analysis, energy balance, computer simulation.
Based on the variables identified, the	– Records that show the chosen EnPI is appropriate for the significant

Evidence	Tools and techniques
appropriate EnPI for significant energy use is identified and quantified.	energy use, e.g. minutes of meeting, recommendation by original equipment manufacturer, books, trade magazines, training courses. – Research on the internet to list a range of EnPIs to be used for quantifying energy performance of significant energy use. – Measure and calculate the efficiency of the significant energy use based on the above findings, or engage a contractor to do so. – Measure and calculate the efficiency of the significant energy use according to other standards, or engage a contractor to do so. Standards include: • BS 845 for boiler efficiency; • ISO 11011 for compressors.
The future energy consumption has been forecast using all available data.	Demonstrable use of data analysis to normalize energy data and then to predict the energy consumption of the significant energy use. Note The standard does not specify for what period the forecast should be. So it is up to the organization to define the forecasting period, e.g. until the next month, next meeting, next quarter or next year.

FAQs

Question 17-14: Why does ISO 50001 imply that more work may be required than a simple analysis of monthly invoices?

Answer 17-14: In a simple organization with a small number of machines, an analysis from monthly invoices could be sufficient to comply with the requirements of bullet points (a)–(c).

For most businesses, with a lot of equipment and many machines, an analysis of monthly invoices tells only part of the picture of where energy

is used. More data are necessary to identify how energy is distributed beyond the meter and how it is used within the business.

The key thing is to match your analysis with your energy policy (which should have already taken account of the complexity of the organization) and to remember your declared scope and boundaries.

Question 17-15: What is significant energy use?

Answer 17-15: The 'significance' of energy use is a subjective determination by the organization, providing the use meets at least one of two criteria, which are that:

- the energy consumption is large in proportion to other energy use.
- the energy use offers opportunities for energy performance improvement.

Some organizations use a strict cut-off rule by identifying 80 per cent of the energy consumption as significant and leaving the remaining 20 per cent of the energy use. One frequently ignored energy use is transportation for a business operation.

Some energy uses can form a big proportion of energy consumption but have little known opportunity for energy performance reduction. Some organizations classify these energy uses as not significant. The opportunity cost for such a move is that the organization may lose sight of monitoring the deteriorating energy consumption and/or exploiting newer techniques and technology.

Some frequently ignored processes when carrying out an energy analysis are waste processes within the organization. All waste streams, particularly if hot or chilled, have energy content that would have been supplied before disposed of as waste.

Other frequently ignored energy uses are the energy uses by 'support areas' such as staff facilities, canteens, contractor compounds and technicians' workshops. If left unchecked, the energy consumption of these areas could become large.

Question 17-16: How does an organization carry out the activities necessary to identify significant energy use?

Answer 17-16: There is a large choice of tools available to assess the energy flows in the organization to quantify significant energy flows, identify the appropriate EnPI, establish an energy baseline and identify opportunities for energy performance improvement.

Some of these tools are:

- Spot measurement of energy use;

- Energy audit;
- Energy kaizen, treasure hunt, workshop, etc.;
- Energy mapping;
- Energy benchmarking;
- Value chain mapping;
- Application of best practice;
- Activity-based costing;
- Simulation models.

Alternatively, organizations may also choose to engage external support.

When identifying significant energy use, organizations often quickly zoom in on the utilities plant. While utility plant items such as boilers, chillers and air compressors consume a large proportion of energy, they supply their energy to other energy users within the organization – for example, heating systems or process/manufacturing users.

For the utilities to reach the end-users, they are distributed via a series of pipes or electric cables. Energy losses can occur during energy generation at the utilities plant, at the energy user or in the distribution system. It is recommended that organizations analyse the whole system when analysing energy flows, and determine the significant energy use and energy performance; for example, instead of analysing just the boiler or just the pump, analyse the whole hot water system – boilers, pumps and all interconnecting pipework to the end-user.

Question 17-17: What is the meaning of 'variable' used in subclause 4.4.3?

Answer 17-17: A variable is something that causes energy consumption to vary. Sometimes, there is only one variable to cause energy consumption to vary. At other times, there is more than one variable that causes the energy consumption to vary.

Take an indoor shopping mall, for example; the energy use for ventilation and air conditioning could vary with ambient temperature. It could also vary with the level of occupancy of the building.

For a similar-sized building to that above, but one that stores sensitive and precious historical artefacts, humidity could be the critical factor that drives the energy consumed.

Some form of statistical analysis is necessary to test the correlation of each variable to identify the variable with the strongest relationship with energy consumption. This analysis results in what are termed normalized values for the energy baseline.

In some instances, multiple variables control the energy consumption simultaneously. An example is a shopping mall or airport where the energy consumed varies with ambient temperature and the number of

occupants or passengers. Another example is a manufacturing plant making several different products or making one type of product of different sizes or grades. In such cases, a composite (multi-variable) relationship can be established and used.

Subclause 4.4.3, bullet point (c)

What does ISO 50001 say?

Finally, bullet point (c) in subclause 4.4.3 requires an organization to identify, prioritize and record opportunities for improving energy performance.

What does ISO 50001 mean?

Bullet point (c) in subclause 4.4.3 requires the organization to identify opportunities to improve its energy performance related to the significant energy use. Then it requires the organization to prioritize the implementation of these opportunities. Finally, it requires the organization to record the list of opportunities and the priorities assigned to each of the opportunities for improvement.

For those who are not familiar with the range of opportunities available to improve energy performance, it is hoped that the multiple meetings with people operating the significant energy use, the equipment provider, maintenance provider and insurance inspector, and various books and internet searches up to this point have provided a range of ideas for improvement.

Alternatively, the services of an external service provider could be beneficial.

Related term(s) and definition(s)

3.11 energy objective
3.17 energy target

Related clause(s)

4.3 Energy policy
4.4.6 Energy objectives, energy targets and energy management action plans

Evidence

Evidence	Tools and techniques
Have criteria to prioritize the implementation of opportunities.	Criteria for ranking opportunities for energy performance are recorded. Evidence includes: – When interviewed by auditor, a representative sample from top management, the management representative and the energy management team give the same criteria; – Minutes of meeting related to energy planning process or energy review; – Minutes of management review meetings; – Energy policy, with criteria stated; – EnMS, with criteria stated. Note The standard does not specify what constitute criteria for ranking opportunities for improvement. These could be criteria based on: – return on investment, e.g. simple payback, discounted cash flow analysis, internal rate of return, net present value, life-cycle analysis or real options analysis; – reduction in CO_2 emissions; – improvement in corporate social responsibility; – green credibility; – other non-energy-based benefits, e.g. maintenance reduction, waste reduction, or increase in production volume using the same equipment. Note Prioritizing and ranking of opportunities could also mean that some opportunities are deferred until a point in the future, e.g. plant expansion, or isolation and decommission of a certain plant item. Some opportunities could be

Evidence	Tools and techniques
	recorded as 'not to be implemented' or 'rejected'.
Have generated and compiled a list for improving energy performance.	– List of opportunities to improve energy performance, available to an auditor. – Reports from an independent energy audit. – Recommendation from energy kaizen events, treasure hunts and total product maintenance. – Recommendations from equipment manufacturer and service provider.
Have prioritized the list of opportunities to improve energy performance.	Have used the agreed criteria to prioritize the identified opportunities for energy performance improvements. Evidence includes: – If a list is used, additional columns are used to record the ranking and priority of implementation; – Record on the front of each energy audit report on the ranking and priority assigned to it.

FAQs

Question 17-18: How can my organization identify opportunities for improvements?

Answer 17-18: The ability to identify opportunities to improve energy performance relies on the organization having the knowledge and capability to improve the energy performance of the significant energy use. Sometimes the organization has the necessary capabilities, but, at other times, external support may be needed.

Many tools are freely available to the organization to identify opportunities to improve energy performance. A shortlist of these tools is:

- Employee suggestion or incentive schemes;
- Team meetings, etc.;

- Housekeeping, the '5S Principles of Manufacturing Management', etc.;
- Training needs analysis;
- Lean manufacturing, Six Sigma, Kaizen, etc.;
- Manufacturer's/design data analysis;
- Better maintenance techniques;
- Energy awareness and culture change;
- Review of case studies for ideas, and trade magazines;
- Energy requirement analysis;
- Energy loss analysis and Sankey diagrams;
- Energy audits;
- System efficiency analysis;
- Survey of best practices;
- 'Pinch Analysis' (thermal analysis).

The internet and published media contain a lot of information on ideas, techniques and technologies to improve the energy performance of many items of equipment. Many equipment suppliers also provide products and services to improve their own products.

Question 17-19: How do I know that the opportunities to improve energy performance are credible and applicable to my organization?

Answer 17-19: All good sources of information and reference books encourage organizations to implement opportunities that are low cost and easy to implement first.

Some publications call this the 'three Rs': 'reduce, reuse and recover'. Other publications may also call this the 'energy management maturity' model. The principles behind the concept are:

1. Where applicable, minimize energy consumption. This could involve better housekeeping, stopping and preventing leaks, reductions in defects, idle time, production rate losses, awareness, education and training, turning off when not in use or when not necessary.
2. Gain control and achieve predictability of energy use and energy consumption. This could involve examining the equipment efficiency and system half-life, tightening the control limits, better scheduling, improving the standard operating procedures, using better control and measurement techniques, and using high-efficiency equipment.
3. Then, reuse and recycle thermal energy. Ideally, this is achieved locally via direct use without the need for tanks, pipework and pumps. Other opportunities may include waste heat recovery, or redesign to use less energy, for example through closed systems, the use of pre-heaters and economizers, or modern packings in separation columns.

These opportunities tend to reduce the variation in energy consumption, reduce the energy consumption (hence making the energy baseline smaller) and contribute to lowering the capital cost of future opportunities.

In principle, some of the easy wins are:

- Good maintenance;
- Correct installation;
- Sizing to match demand;
- Turning off when not required;
- Operating to match demand;
- Controlling and minimizing start up and shut down;
- Applying good insulation;
- Using heat recovery

Note Chapter 9 also gives advice and guidelines on improving energy efficiency.

4.4.4 Energy baseline

Subclause 4.4.4 is explained over two parts:

- Paragraphs (1) and (3);
- Paragraph (2) and its bullet points.

Subclause 4.4.4, paragraphs (1) and (3)

What does ISO 50001 say?

Subclause 4.4.4 requires an organization to establish, maintain and record energy baseline(s) using the information obtained from the initial energy review. It then requires an organization to measure any changes in energy performance by means of comparison to the energy baseline(s).

What does ISO 50001 mean?

Subclause 4.4.4 requires the organization to use the same energy data used in subclause 4.4.3 (energy review) to 'generate quantitative reference(s) providing a basis for comparison of energy performance'.

It is always difficult to get the structure of a standard exactly right, and it may seem that subclause 4.4.4 is in the wrong place. After all, it is difficult to set up an energy baseline before identifying and describing the reasons, i.e. the variables that cause the energy consumption to vary the way it does.

Therefore, we recommend that subclauses 4.4.3, 4.4.4 and 4.4.5 are read and implemented together. Alternatively, we recommend that subclause 4.4.5 (EnPIs) is read and implemented before subclause 4.4.4.

Related term(s) and definition(s)

3.6 energy baseline

Related clause(s)

4.4.3 Energy review
4.4.6 Energy objectives, energy targets and energy management action plans
4.6.1 Monitoring, measurement and analysis

Evidence

Evidence	**Tools and techniques**
An energy baseline has been established.	– Ensure that a quantitative reference exists that allows a comparison of energy performance over time. (This is the 'energy baseline'.) – Ensure that there is evidence that the energy baseline does represent a true basis for comparison. For example, that when interviewed by an auditor, the EnMS management representative or the energy management team can explain and/or show: • an attempt has been made to relate energy consumption with the variables that might affect energy consumption. For a small organization this might be a simple description. For larger, more complex organizations multiple spreadsheets may be required. • if appropriate, a scatter plot chart of energy consumption

Evidence	Tools and techniques
	and the variable, to determine the best-fit line; • if appropriate, a statistical analysis of energy consumption with a variable, with indication of coefficient of determination (R^2) value; • if appropriate, a multi-variable analysis. – Report from an external consultant detailing the energy baseline for the organization.

FAQs

Question 17-20: What constitutes an energy baseline?

Answer 17-20: At heart a baseline is a quantitative, referential framework, where care has been taken to ensure that apples can be compared with apples rather than pears. Chapter 11 gives an overview of measurement and baselines. Energy baselines are also covered in the FAQs section for energy review (4.4.3) (see page 139).

Although the standard does not specifically state that the energy baseline should be normalized it is difficult to see how it can be a basis for comparison unless it is. The amount of normalization required obviously depends upon your energy policy. For a very simple implementation it may be adequate to demonstrate that factors such as seasonality or working patterns have been taken into account. For more complex implementations there may be the need for detailed data analysis and the application of statistical techniques.

The key thing is to be able to demonstrate to an auditor that the baseline is quantitative and that it provides an adequate basis for comparing one of the three elements that make up 'energy performance' (energy efficiency, energy use and energy consumption).

Subclause 4.4.4, paragraph (2) and its bullet points

What does ISO 50001 say?

Paragaph (2) of subclause 4.4.4 sets out three conditions when an organization should change or adjust the energy baseline(s):

- EnPIs used are no longer representative of energy use and consumption;
- Major changes to the process, operational patterns or energy systems have occurred; or
- According to a defined condition, the organization chooses to review the energy baseline.

What does ISO 50001 mean?

Subclause 4.4.4 informs the organization that, in order to ensure the continued effectiveness of an EnMS in improving energy performance, energy baseline(s) need to be kept under review and adjusted as necessary.

The need for a review could be as result of:

- finding that the variables thought to affect the quantum of energy consumption are not accurate or not true;
- successful implementation of energy performance improvement projects;
- changes in operating patterns or changes in business needs;
- changes in the process, machinery or infrastructure that will lead to a change in energy performance;
- any other criteria the organization chooses to set to trigger a review of the energy baseline(s).

Related terms(s) and definition(s)

3.6 energy baseline
3.15 energy review

Related clause(s)

4.4.3 Energy review
4.4.6 Energy objectives, energy targets and energy management action plans
4.6.1 Monitoring, measurement and analysis
4.6.5 Control of records

Evidence

Evidence	Tools and techniques
Energy baseline is valid for the organization.	Energy baseline and energy forecast are reasonably accurate. Evidence of this includes: – Taking into consideration, for example, actual product sales or the volume of service provided, the actual consumption compared with the energy baseline is reasonably accurate. – Actual energy consumed is close to an energy 'budget' as calculated from the energy baseline. – Ongoing analysis of the chosen energy variable and EnPIs continues to give a strong correlation (for example, as reflected in R^2 values).
A process exists to review and revise energy baselines.	– The management representative and/or energy management team can explain or show to an auditor: • the initial energy performance indicator, revisited to identify errors and perform a root cause analysis on the deviation. • new variables and EnPIs established and the energy baseline recalculated. • new energy data used to redraw the energy baseline(s). – Records from the energy planning process showing a deviation in energy performance; investigation resulted in a change in energy baseline. – Records from the output from management review, with an indication where the additional information on the change in energy baseline can be found. Note The revision and/or modification to the energy baseline(s) should also be subject to checks to ensure that it

Evidence	Tools and techniques
	remains correct and valid for the organization.

FAQs

Question 17-21: Why would the energy baseline of an organization change over time?

Answer 17-21: An energy baseline can become invalid because of:

- improved knowledge and understanding of how the significant energy users consume energy, due, for example, to the installation of additional metering and monitoring techniques;
- successful implementation of opportunities to improve energy performance;
- changes in the operating characteristics, for example new machinery, operating conditions, new client contractual agreements, or product specifications.

As more and more data are measured, collected and made available for analysis, the organization can increase its understanding on how the variable changes energy consumption.

The organization may find that the chosen variable is the wrong variable for analysis, because the energy consumption does not vary in the same proportion with the chosen variable. The organization may also discover another variable with a stronger correlation.

Setting and continually improving the energy baseline should be part of the organization's learning journey.

4.4.5 Energy performance indicators

What does ISO 50001 say?

Subclause 4.4.5 allocates to the organization a responsibility to identify appropriate EnPIs for monitoring and measuring its energy performance. It gives the organization freedom to choose a methodology for determining and updating the EnPIs, providing it is recorded, reviewed and compared with the energy baseline(s).

What does ISO 50001 mean?

Subclause 4.4.5 requires the organization to record the method used to identify suitable EnPI(s), to ensure that the chosen EnPI(s) remain appropriate for use, and to review them as and when necessary.

Subclause 4.4.5 is one of two clauses in the standard which is out of place. The other subclause is 4.4.4 (energy baselines).

As noted in the section on 4.4.3, bullet point (b), subclause 4.4.5 (EnPIs) and subclause 4.4.4 (energy baselines) would have made more sense to the readers within the bullet points in subclause 4.4.3 (energy review).

We recommend that subclauses 4.4.3, 4.4.4 and 4.4.5 are read and implemented together. Alternatively, we recommend that subclause 4.4.5 (EnPIs) is read and implemented before subclause 4.4.4.

In general, an organization can choose many types of EnPI to measure energy performance. These range from overall organizational EnPIs and department-level EnPIs down to system- or equipment-based EnPIs.

An organization may choose to allocate the authority and responsibility for EnPIs as far down an organizational hierarchy as possible. This encourages employee buy-in and thus plays a part in improving energy performance.

EnPIs can range from simple ratios and matrixes to multi-variable models. All EnPIs, when used without care and insight, can be misused and misinterpreted. When deciding which EnPIs to use in the organization, care should be taken to: choose EnPIs that are meaningful to the organization; to understand the assumptions on which the EnPIs are based; and to record the reasons for their choice. EnPIs can then be used diligently and without deviating from assumptions used in their formulation.

In the context of ISO 50001, EnPIs are used to:

- measure the existing energy performance between monitoring periods;
- measure the energy performance before and after implementing opportunities to improve energy performance.

For a good discussion on EnPIs, please see Chapter 11, page 89.

Related term(s) and definition(s)

3.6 energy baseline
3.12 energy performance
3.13 energy performance indicator (EnPI)
3.15 energy review

Related clause(s)

4.4.3 Energy review
4.4.4 Energy baseline
4.4.6 Energy objectives, energy targets and energy management action plans
4.6.1 Monitoring, measurement and analysis

Evidence

Evidence	**Tools and techniques**
EnPIs have been identified.	– A list of EnPIs has been recorded and justified, e.g. in minutes of meeting, energy review, energy planning process, or external consultant's report. – The management representative and/or energy management team can describe and/or show: • why the EnPIs were chosen. • how the EnPIs are used in the organization. • that they know how to compute the chosen EnPIs.
EnPIs have been used.	– The management representative and/or energy management team can show: • EnPIs have been used in conjunction with energy baseline(s) to forecast energy consumption. • EnPIs have been used to monitor the energy performance of the organization. – Records of the energy planning process, energy review and

Evidence	Tools and techniques
	management review show that EnPIs have been used.
If relevant, EnPIs have been reviewed and/or modified.	If EnPIs were found to be inappropriate, that changes to EnPIs have been recorded. These could be recorded as part of: – Energy planning process; – Energy review; – Management review; – Records of EnPI being modified; – Responses to investigations being carried out.

FAQs

Question 17-22: How do I make sure that EnPIs have been designed properly?

Answer 17-22: There are many ways of designing good EnPIs for significant energy use. Many good energy management books provide several methods for achieving this. Each method has slightly different procedures and a slightly different basis for calculating EnPIs.

For example, steam boiler efficiency could be calculated based on the following:

- Heat input in terms of net or gross calorific value;
- Direct or indirect method;
- Primary or delivered energy basis;
- Specific water inlet temperature;
- Specific air inlet temperature;
- Specific elevation from sea level;
- Seasonal composite efficiency.

The important point is to choose a basis for the design of your EnPIs, to check that the basis is accurate and repeatable, to record the basis, to make sure everyone understands the basis, and to continually use the same basis to calculate EnPIs. If in doubt, an external consultant can be used to advise on the suitability of the chosen design of your EnPIs.

Question 17-23: Should EnPIs be assigned to specific individuals in the organization?

Answer 17-23: Selecting EnPIs is one of the most critical steps to measure energy performance improvements. So it is somewhat surprising that there is no requirement to assign EnPIs to a specific, appropriate person or to specific groups of people.

In our view, for effective control of energy consumption and to minimize the potential for deviations, it is important to use a range of EnPIs tied to the person or position who has the most appropriate and direct knowledge and responsibility for the actions necessary to control any (and potential) energy deviations.

For example, EnPIs associated with site steam boilers, such as 'boiler efficiency at gross calorific value basis' are under the control of the utilities or facilities manager. The EnPI is outside the influence and control of the manufacturing manager. In the best case, if the EnPI is assigned to the manufacturing manager, he or she redirects the information to the right person for effective planning and control. In the worst case, the information is deleted and ignored.

To take another example, a maintenance technician would be able to respond to EnPIs such as (1) time allocated to maintain the equipment, and (2) following the prescribed maintenance procedure. However, assigning an EnPI such as 'reduce energy consumption by 4 per cent' is of little use to the maintenance technician, whose work could not affect the overall business energy performance.

4.4.6 Energy objectives, energy targets and energy management action plans

Subclause 4.4.6 is explained over two parts:

- Paragraphs (1), (2) and (3);
- Paragraphs (4) and (5).

Subclause 4.4.6, paragraphs (1), (2) and (3)

What does ISO 50001 say?

Subclause 4.4.6 requires an organization to establish, implement and maintain energy objectives and targets at the relevant functions, levels, processes or facilities within the organization.

The objectives and targets chosen should be consistent with the energy policy and consider its financial, operational and business conditions, technological options and the views of interested parties. Targets shall be consistent with the objectives.

Subclause 4.4.6 also requires an organization to establish and work towards achieving the objectives and targets within a specified time frame.

What does ISO 50001 mean?

Subclause 4.4.6 is where the outputs from the activities required by the other subclauses in 4.4 are brought together into a range of energy objectives and targets.

Subclause 4.4.6 requires the organization to take the outputs from an energy review, legal requirements and other requirements, energy baselines, EnPI(s) and opportunities to improve energy performance and to analyse them in order to generate a set of objectives and targets specific to energy. These objectives and targets should be measurable, realistic and achievable within a specified time frame.

In the energy planning process and energy review, there are a range of tasks appropriate to all employees working with 'significant energy use'. ISO 50001 requires the organization to disseminate the objectives and targets to the relevant job functions and responsibilities. Remember, personnel working on these objectives and targets also need resources to complete each objective and target in a timely manner.

If the energy planning and review processes have been carried out correctly, the objectives and targets should be aligned with the requirements of the organization's energy policy. ISO 50001 tasks the organization to check that its energy objectives and energy targets are aligned with the energy policy. Remember that the energy policy should have already declared the relevant scope and boundaries for the implementation.

Related term(s) and definition(s)

3.6 energy baseline
3.11 energy objective
3.14 energy policy
3.15 energy review
3.17 energy target
3.19 interested party
3.27 significant energy use

Related clause(s)

4.3 Energy policy
4.4.2 Legal requirements and other requirements

4.4.3 Energy review
4.4.4 Energy baseline
4.4.5 Energy performance indicators

Evidence

Evidence	Tools and techniques
Objectives and targets are available.	Tabulated list of objectives and targets. This list could be in, or take the form of: – Tables; – Minutes of meetings from management review or energy planning processes; – Organizational balance scorecard, strategy maps, waterfall analysis, road maps that contain elements of energy performance and EnMS related elements; – Energy glide path diagrams.
Objectives and targets were generated by taking into consideration the outputs from the energy planning process.	The management representative and/or energy management team can describe and/or show an auditor how the objectives and targets related to 'significant energy use' were created, using, for example: – Records from the energy planning process and energy reviews; – Records of legal requirements and other requirements; – Minutes of meetings discussing proposals from energy consultants and equipment suppliers.
Objectives and targets are aligned with the energy policy.	The management representative and/or energy management team can show and/or describe to an auditor how the objectives and targets relate to the energy policy, by showing, for example: – A comparison between the energy policy document and a record of objectives and targets; – That the sum of the contribution from all opportunities to improve

Evidence	Tools and techniques
	energy performance is equal to the overall intent of the energy policy.
Objectives and targets are allocated to the right level of job function and responsibility.	– Records of communication specific to the assigned objectives and targets, minutes of meeting, attendance record with clear indication of the title of the meeting, presentations slides, etc.; – Records from job description, performance appraisal, performance reviews, etc.; – Tables or matrices showing the roles or responsibilities of each person or group against specific energy objectives, targets and assigned tasks. Some companies call these matrices responsible, accountable, consulted, informed (RACI) charts.
A time frame has been developed and agreed.	– Records of objectives and targets containing a timeline to achieve them. – Auditor interviews a representative sample of employees to find out their roles in achieving stated objectives, targets and the timeline to complete the tasks.

FAQs

Question 17-24: What is the difference between the energy policy, energy objective, energy target and action plans?

Answer 17-24: We said at Answer 16-1 that in the context of an EnMS the energy policy gives the overall results to be achieved and the guiding principles to achieve the overall results. An overall result could be 'to reduce the organization's energy consumption by 10 per cent in three years'.

Energy objectives and targets break an energy policy down into workable chunks. Action plans are essentially what they infer: a plan to achieve an energy target(s) related to an energy objective(s). Using the same

example, an objective energy target for the first year could be to reduce energy consumption in support services by 5 per cent, and this then is broken down into an energy target of reducing energy consumption in support services by 2.5 per cent within the next 12 months. ISO 50001 makes it clear that an energy target has to be quantifiable and thus measurable.

Defining policy, objectives, targets and action plans in this logical way, greatly increases your chances of a successful implementation.

Question 17-25: Does my organization need to have a long list of energy objectives, energy targets and action plans?

Answer 17-25: There is no 'correct' answer to this question, but in general it is best to focus on a few achievable objectives. Some organizations set too many (e.g. seven or more) objectives and targets (many management gurus recommend focusing on three to five objectives per year). Employees become confused with a large pool of work requirements and how each relates to the bigger picture, and lose interest in carrying them out. If not careful, focusing on too many objectives for improving energy performance could lead employees to lose focus on business-critical issues. A balance between organizational needs and energy performance improvement needs to be established and maintained.

As long as an organization records all opportunities for improvement in energy performance, then prioritizing and implementing a select few objectives at one time is perfectly acceptable. The important point is to select meaningful objectives and targets, communicate them to the relevant personnel, and make sure to allocate the appropriate resources to implement the tasks.

Question 17-26: Is statistical analysis a good way of determining objectives and targets?

Answer 17-26: Statistical analyses such as regression analysis, expected energy consumption and cumulative sum (CUSUM) analysis are some of the available ways to determine targets to be used in an objective. Other methods are based on energy efficiency, energy base load analysis, energy benchmarks, historical energy performance, etc.

ISO 50001 requires an organization to identify objectives and targets and to produce an action plan to achieve those objectives and targets. The challenge to using historical performance and statistical analysis is to understand what the factors that caused the change observed were.

CUSUM analysis might indicate that there is room for improvement in energy performance, and it can be tempting to set an aggressive target.

However, before you do, make doubly sure that you fully understand the likelihood of influencing the variables driving the CUSUM analysis.

Question 17-27: Should I use the SMART (Specific, Measurable, Achievable, Relevant and Time-bound) framework to set objectives, targets and action plans?

Answer 17-27: SMART is a good framework for setting objectives, targets and action plans. Other methods are also available and are just as acceptable. The trick is being able to explain the reasons for choosing any particular framework.

Subclause 4.4.6, paragraphs (4) and (5)

What does ISO 50001 say?

The second part of subclause 4.4.6 requires the organization to establish, implement, maintain and record an action plan to achieve its objectives and targets. ISO 50001 requires the organization to include the following information in the action plans:

- Designation of responsibility;
- Means and time frame to achieve individual targets;
- Method to verify that the improvement in energy performance has been achieved.

Finally, the clause requires an organization to update the action plans at defined intervals.

What does ISO 50001 mean?

The second part of subclause 4.4.6 requires an organization to translate the objectives and targets into a detailed yet workable action plan. The purpose of the action plan is to generate work items that will, when implemented successfully, meet the designated energy objectives and energy targets.

To conform to the requirements of ISO 50001, subclause 4.4.6 requires the organization to identify:

- the person to carry out the task;
- how the task is to be carried out;
- when the task should be completed;
- how the organization can verify if the task is complete;
- how the organization can verify that the completed task has generated the quantifiable improvement in energy performance.

As a working document, the action plan is to be updated regularly, at an interval defined by the organization.

Related term(s) and definition(s)

3.11 energy objective
3.17 energy target

Related clause(s)

4.5.2 Competence, training and awareness

Evidence

Evidence	Tools and techniques
An up-to-date action plan is available and contains the items in each bullet point of subclause 4.4.6.	– List of action plans or programme schedules to improve energy performance, with up-to-date status, is available to an auditor for inspection. – Records from minutes of, for example, a meeting or management review, containing the information required. – Notes written or stuck on the front cover of a series of energy audit reports containing the information required and the status of the opportunity.
The action plan is consistent with the required energy targets and energy objectives.	– The management representative and/or energy management team can describe to an auditor how the action plan contributes towards the energy objectives and energy targets. – The combination of the projected energy performance improvements from the action plans are reasonable to meet the requirements of the energy objectives and targets. Note There is some degree of subjectivity, as not all action plans may

Evidence	Tools and techniques
	directly result in an energy performance improvement. For example, some tasks could be enablers for improvements in energy performance to occur elsewhere.
Statement on how the organization plans to measure the improvement in energy performance.	Records of how the organization intends to measure energy performance improvements. These can be contained in: – Minutes of meetings for objectives and targets or action plans; – Notes on the individual project proposals; – How the organization measures the improvement is not specified in the standard. The organization has a choice and can, for example: • Carry out data measurements before and after the implementation of projects; • If the project to improve energy performance comes with an automatic energy metering device, compare the reading from this with previous readings; • Use an independent standard measurement and verification protocol; • Engage an independent energy consultant to verify the performance.
Verify the results of the improvement.	When opportunities to improve energy performance have been implemented, the organization has verified the achieved results by, for example: – Record of the before and after readings for the project; – Report from a contractor or consultant verifying and documenting the achieved energy

Evidence	Tools and techniques
	performance improvement.
A time frame has been developed and agreed to review and update the action plan.	The date when the action plan was last reviewed and updated is recorded on the action plan along with the next review date. The EnMS, energy planning process and energy review contain a time frame within which the action is to be reviewed and updated. The action plan is updated according to the specified time frame.

FAQs

None

Chapter 18 – 4.5 Implementation and operation

You will notice that subclause 4.5 makes a lot of references to subclauses 4.3 and 4.4. This is because subclause 4.5 is about executing the plans that you have already made – hopefully! This should result in an outcome that is aligned and in accordance with the energy policy.

4.5.1 General

What does ISO 50001 say?

Subclause 4.5.1 requires the organization to implement the outputs from subclause 4.4 (planning).

What does ISO 50001 mean?

Subclause 4.5.1 is a general introduction to subclauses 4.5.2 to 4.5.7. The specific requirements for subclause 4.5.1 are captured in subclauses 4.5.2 to 4.5.7.

Related term(s) and definition(s)

None

Related clause(s)

None

Evidence

Evidence	Tools and techniques
None	None

FAQs

None

4.5.2 Competence, training and awareness

Subclause 4.5.2 is explained over two parts:

- Paragraphs (1) and (2);
- Paragraph (3).

Subclause 4.5.2, paragraphs (1) and (2)

What does ISO 50001 say?

The first part of subclause 4.5.2 requires the organization to ensure that all people working on significant energy uses are competent on the basis of education, training, skills or experience. Records of competence and training needs are to be maintained and regularly updated.

What does ISO 50001 mean?

Subclause 4.5.2 informs the organization that all employees working on any significant energy use or who could affect energy performance are to be competent in relation to energy management.

It requires an organization to carry out a training needs analysis so that necessary skills and competencies are properly identified and recorded. This allows any gaps between the required skills and competencies and those possessed by relevant employees or contractors to be identified. Such gaps should then be filled by appropriate education, training, or work experience.

In order to conform to ISO 50001, records of the people's skills and competencies in relation to energy management are to be kept, reviewed and regularly updated.

Related term(s) and definition(s)

3.25 record

Related clause(s)

4.4 Energy planning

Evidence

Evidence	Tools and techniques
Top management is competent to select energy performance indicators (EnPIs) relevant to organization, specified in subclause 4.2.1 (see Chapter 15).	Record of competency requirements is described in terms of education, training, skills or experience. This record could be located in, for example: – A resumé; – A job description; – A roles and responsibility matrix; – A certificate of attendance in appropriate training; – A performance appraisal.
The management representative is competent in carrying out the defined responsibilities specified in subclause 4.2.2 (see Chapter 15).	Record of competency requirements is described in terms of education, training, skills or experience. This could be located in, for example: – A resumé; – A job description; – A roles and responsibility matrix; – A certificate of attendance in appropriate training; – A performance appraisal.
Energy management team is competent carrying out its defined responsibilities.	Record of competency requirements is described in terms of education, training, skills or experience. This could be located in, for example: – A resumé; – A job description; – A roles and responsibility matrix; – A certificate of attendance in appropriate training;

Evidence	Tools and techniques
	– A performance appraisal.
Competence of all other personnel working with significant energy use has been defined.	List of names or positions of people working on significant energy use is available. This could be, for example: – A list of names or positions of people working on significant energy use; – A list of names or positions of people working on significant energy use, documented in the energy management system (EnMS); – Recorded in minutes of, e.g. meetings or management reviews; – Recorded in organization charts and job descriptions. Record of competency requirements is available describing appropriate education, training, skills or experience. This could be located in: – a job description; – a roles and responsibility matrix; – training certificates; – a performance appraisal.
Training needs and gap analysis, and that where there is a shortfall, a programme has been put in place to close the gaps.	Documentation showing: – training plans; – performance appraisal; – coaching and mentoring from experienced peers; – attendance at relevant workshops, seminars and training; – other record of training; – the reassignment of employees in order to gain specific experience.
Records of competency are regularly reviewed and updated.	Competency records are reviewed and updated: – as part of annual appraisal; – annually during retraining/refresher courses for employees; – when there is a significant change in operations and maintenance

Evidence	Tools and techniques
	requirements.

FAQs

Question 18-1: What is the difference between education, training, skills and experience?

Answer 18-1: ISO 50001 does not provide a definition of any of these terms. To do so would have required a standard all of its own! However, it can be said that 'in general' education is related to the acquisition of subject or scholastic knowledge, whereas training is related to the acquisition of specific skills or knowledge. See Answer 15-8 for guidance on skills and competence.

Question 18-2: What is the acceptable level of competence?

Answer 18-2: See answer 15-8.

Subclause 4.5.2, paragraph (3)

What does ISO 50001 say?

The second part of subclause 4.5.2 requires the organization to ensure that all employees and contractors are aware of:

- the need to conform with the energy policy, procedures and the EnMS;
- their roles, responsibilities and authorities;
- the benefits of improved energy performance;
- the impacts and consequences of their work on achieving energy objectives and targets.

What does ISO 50001 mean?

The second part of subclause 4.5.2 informs the organization that, in order to conform to ISO 50001, it is the responsibility of the organization to communicate to all personnel (internal, contractors and maintenance services):

- the importance and consequence of conformity (or nonconformity) with energy policy, procedures and ways of working within the organization;
- the roles and responsibilities of each person;
- the benefits of improved energy performance.

The standard does not specify how an organization is to make all workers aware of the listed items. It is up to the organization to determine the appropriate methods to achieve the requirement.

Related term(s) and definition(s)

3.9 energy management system (EnMS)
3.11 energy objective
3.17 energy target
3.21 nonconformity
3.24 procedure

Related clause(s)

4.3 Energy policy
4.5.3 Communication

Evidence

Evidence	Tools and techniques
Appropriate meetings contain all of the information listed in subclause 4.5.2.	Records of communication (see page 179) shows that the items listed in subclause 4.5.3 have been discussed, including: – Presentation slides; – Training syllabus; – Briefing notes; – List of attendees, agenda and minutes of team meetings;

Evidence	Tools and techniques
	– Records of training.
All personnel working for the organization (internal and external resources) are aware of the bullet points listed in subclause 4.5.2.	– Employees can describe to an auditor the content of the awareness meetings. – Employees can answer questions from an auditor on their job function in relation to energy performance and the EnMS. – Employees can show an auditor examples of their contributions towards energy performance and the EnMS.

FAQs

None

4.5.3 Communication

Subclause 4.5.3 is explained over two parts:

- Paragraphs (1) and (2) (internal communication);
- Paragraph (3) (external communication).

Subclause 4.5.3, paragraphs (1) and (2)

What does ISO 50001 say?

The first part of subclause 4.5.3 requires the organization to communicate internally to all employees and contractors with regard to the organization's energy performance and EnMS.

The standard requires the organization to establish and implement a process for employees and contractors to submit comments on, or suggest improvements to, the EnMS and to be given opportunities to improve energy performance.

What does ISO 50001 mean?

The first part of subclause 4.5.3 informs the organization that it has a responsibility to inform all employees and contractors working on its behalf about energy performance and its EnMS.

All clauses within ISO 50001 involve some elements of communication. However, subclause 4.5.3 describes the main communication mechanism: it links with all other clauses.

In the context of a management system, a 'communication' is a two-way phenomenon. Simply issuing a directive or pinning up a poster does not constitute a 'communication'. The message of a communication has to be received by the employees and contractors, understood and reciprocated.

Sometimes it can be difficult to directly measure the effectiveness of communication. However, indirect measurement is possible. For example, ISO 50001 explains that the level of understanding within the organization about energy performance and the EnMS, or the level of participation in 'suggestion schemes', both represent an indirect measurement of how effective the communication has been.

Related term(s) and definition(s)

3.19 interested party
3.22 organization

Related clause(s)

All

Evidence

Evidence	Tools and techniques
There has been communication with regards to the organization's energy performance and EnMS.	Records to demonstrate that communication to relevant personnel with respect to energy policy, the EnMS and energy performance improvements have been carried out, e.g.: – Minutes of meetings; – Copies of presentations; – Briefing letters and/or memos; – Emails;

Evidence	Tools and techniques
	– Employee newsletters; – Dialogues, discussion, etc.; – Details of large-group meetings, workshops, etc.; – Notice boards; – Information on an intranet; – Staff bulletins; – Records of daily meetings. Random interview of employees by an auditor on topics such as energy performance and EnMS, in order to ascertain knowledge of: – recent energy performance; – location where energy performance information can be found.
A mechanism or process is available for employees to provide suggestions to improve energy performance and the EnMS.	The management representative, energy management or any employees and contractors can show an auditor how to make suggestions for improvement of energy performance or of the EnMS. There is a known means to put forward suggestions through, e.g.: – A procedure for employees to contribute suggestions; – Suggestions box; – PDCA forms, Kaizen forms.
Employees are aware of the mechanism to provide suggestions for improving energy performance and the EnMS, or there is evidence that employees have provided suggestions.	Employees and contractors can inform an auditor how they can raise an idea for improvement, e.g. they can: – fill in [name] form available in [location]; – use a suggestion box; – see [name] person with suggestions; – bring up suggestions in energy meetings; – channel suggestions up a management structure via team leaders. Records of suggestions being raised or implemented may include, e.g.: – 'Walk the wall' talks; – Newsletters containing details of

Evidence	Tools and techniques
	recent successes; – Minutes of meetings reviewing suggestions received.

FAQs

Question 18-3: Why is it important to communicate to all persons working for, or on behalf of, the organization?

Answer 18-3: There are many reasons to communicate to all persons working for, or on behalf of, the organization. The continuous improvement called for by ISO 50001 relies upon two-way communication and 'closed-loop' management. Without effective communication, the whole system of management and processes breaks down.

Some of the key reasons for communication in ISO 50001 include the need to:

- create buy-in from management and from employees to take action and to keep motivation to engage in activities for energy performance improvement;
- disseminate information paramount to energy performance;
- align roles and responsibilities;
- build trust and break down barriers towards energy performance;
- build accountability.

Question 18-4: What are the areas where communication can break down?

Answer 18-4: The common failures related to communication are:

- Communication occurs from 'top down', and no effort is made to ensure that employees understand the message, buy in to it, and are motivated to implement the communication.
- Communication to employees is on matters relating purely to the necessary, but supporting, elements of the EnMS such as documentation and record keeping.
- Communication does occur, but does not include a clear allocation of authority and responsibility. This may lead to each employee assuming the other employee will take the action, and the 'blame game' begins.
- Communication does not occur, because top management considers these issues trivial.

Subclause 4.5.3, paragraph (3)

What does ISO 50001 say?

The second part of subclause 4.5.3 requires the organization to make and document a decision on whether or not to communicate externally about its energy policy and EnMS. If it does decide to do so, then there is a requirement to document the method of communication.

What does ISO 50001 mean?

The second part of subclause 4.5.3 informs the organization that it should decide whether it wants to communicate its energy policy, EnMS and energy performance externally. It requires the organization to record this decision.

If the organization chooses to communicate externally, it should establish a process where such communication can take place in a controlled manner.

Related term(s) and definition(s)

None

Related clause(s)

4.5.4.2 Control of documents

Evidence

Evidence	Tools and techniques
Organization has made a decision whether to communicate externally.	Record of a decision to communicate externally. This could be found in: – Minutes of relevant meetings such as management review; – Statement in energy policy; – Statement made elsewhere in the EnMS.
If the organization decides to communicate externally, there is a	– A flow chart of the communication protocol. – A chain of command for

Evidence	Tools and techniques
process by which the communication will occur.	communicating with specific external organizations. – Policy/procedure that explains how to communicate with external parties.

FAQs

Question 18-5: Why should an organization want to communicate externally?

Answer 18-5: There are several reasons why an organization may want to communicate externally. For example, it is useful to communicate to:

- regulators, such as local authorities, environment agencies, health and safety executive officers, and so on;
- suppliers;
- customers;
- investors or other stakeholders;
- the general public as part of 'corporate responsibility'.

The purposes for communicating with these groups of people will often be different. It is very unlikely that an organization is completely independent and does not need to communicate to anyone external to the organization.

The organization should recognize the information needs of the different categories of people when deciding how to communicate with them.

4.5.4 Documentation

Subclause 4.5.4 is concerned with the organization's EnMS document. ISO 50001 describes the requirements for an EnMS over two sections:

- 4.5.4.1 Document requirements
- 4.5.4.2 Control of documents

4.5.4.1 Documentation requirements

What does ISO 50001 say?

In order to conform to ISO 50001, subclause 4.5.4.1 requires the organization to establish, implement and maintain a documented EnMS. The EnMS documentation should include:

- The scope and boundaries of the EnMS;
- An energy policy;
- Energy objectives, targets, and action plans;
- Other documents and records specified by ISO 50001;
- Other documents and records deemed necessary.

The EnMS can be created and stored in a medium suitable for the organization.

What does ISO 50001 mean?

Subclause 4.5.4.1 formalizes the minimum documentation for an EnMS to conform to ISO 50001. It informs the organization of the minimum level of documentation necessary to conform to ISO 50001 – the documents listed in the bullet points of subclause 4.5.4.1.

Part A, Chapter 7 is devoted entirely to documentation so please make sure to read it!

The requirements for the scope and boundary, energy policy, energy objectives, targets and actions plans are covered in other clauses of the standard. Conformity of the contents of the documents is assessed by the relevant clauses of the standard.

The subclause also gives the organization freedom to choose the form of the documentation, i.e. printed, electronic, or any other media.

The note to subclause 4.5.4.1 makes it clear that the extent of documentation for an EnMS varies according to the circumstances of the organization. An auditor will be looking to see if the documentation is fit for purpose, meets the requirements of the standard, and will support the goal of continually improving energy performance.

Related term(s) and definition

3.9 energy management system (EnMS)
3.24 procedure
3.25 record

Related clause(s)

All

Evidence

Evidence	Tools and techniques
The documentation required by subclause 4.5.4.1 bullets (a)–(d) is readily available.	There is/are a document/documents describing: – scope and boundary; – energy policy; – energy objectives, targets and action plans; – any other documents the organization deems necessary. This information could be stored together in one document or in separate documents. Documents may be, for example: – printed copies in a folder labelled 'Energy Management System'; – located on notice boards; – on hard disk; – on an intranet; – on the internet.
Any 'other documents' as referenced by subclause 4.5.4.1 bullet (e) are also available and that there is a rationale for their existence.	– Any other documents in addition to those listed in subclause 4.5.4.1 bullets (a)–(d). – The organization can show how the other documents are relevant and necessary.

FAQs

Question 18-6: What is the difference between a document and a record?

Answer 18-6: See Chapter 7, page 41.

In addition to the type of documents discussed by Chapter 7, other examples are:

– Policies;

- System procedures;
- Operational procedures;
- Work instructions;
- Blank forms;
- Manuals;
- Plans, programmes, company initiatives;
- Drawings and schematics;
- Standards and specifications;
- Videos;
- Photographs;
- Performance dashboards;
- Balanced scorecards.

Question 18-7: Should my organization roll out the EnMS even if the documentation is incomplete or imperfect?

Answer 18-7: It is important to start the process of documentation from the word 'go'. It is perfectly normal for the whole EnMS to take some time to implement and to be commissioned. For example, it may not be possible for the first iterations of the energy planning process to cover the entire declared scope and boundary. Or the initial energy data may be incomplete or unrefined.

The key is to begin documentation and begin implementing the EnMS. Record the issues learnt from it, review the actions necessary and improve. No organization in this world has a perfect management system. There is always room for improvement, and every management system will be different.

4.5.4.2 Control of documents

What does ISO 50001 say?

Subclause 4.5.4.2 requires the organization to establish, implement and maintain one or more procedures to control the EnMS documents and other documents deemed necessary by the organization to demonstrate conformity with the standard.

This includes ensuring that:

- documents are approved for use;
- documents are periodically reviewed and updated;
- changes and the revision status of documents are clearly identifiable;
- controlled documents are legible, readily identifiable and available at points of use;
- external documents are identifiable and their distribution is controlled;
- unintended use of obsolete documents is prevented.

What does ISO 50001 mean?

Subclause 4.5.4.2 informs the organization that it has to develop, implement and continually ensure that there is a procedure to control its EnMS documentation as described in subclause 4.5.4.1.

The subclause is concerned with the control and management of the EnMS documents. The requirements for the EnMS documents are covered by and are assessed by the relevant clauses of the standard.

For documents that are located outside an office environment, it may be necessary to apply additional protection against dirt, heat, oil, grease, etc.

Chapter 7 gives extensive guidance on the control of documents.

Related term(s) and definition(s)

3.9 energy management system (EnMS)
3.24 procedure
3.25 record

Related clause(s)

4.5.4.1 Documentation requirements

Evidence

Evidence	Tools and techniques
A procedure(s) exists to achieve subclause 4.5.4.2, bullets (a)–(g).	– One or more procedures are available to describe how the organization controls its EnMS documentation. – The procedure(s) cover(s) the requirements of bullets (a)–(g): • Title, revisions and content are clear and legible. • A clearly defined approval process, e.g.: for the signature of the document; minutes of meetings from the energy planning process and/or

Evidence	Tools and techniques
	management review approving the document, etc. • There is a means to prevent unintended use, e.g.: document is deleted from point of use; it is only filed in archive for record purposes; it is clearly marked as obsolete or superseded. • If relevant, there is an inventory of the locations of all controlled copies of the EnMS documents. – Examples of evidence could be in the form of: • descriptive words in a procedure format; • flow chart format; • step-by-step work flow guidelines. Note EnMS documents should also be prepared in a manner that is understood by all employees. A document that is not understood by relevant employees (e.g. management representative, energy management team) will not be implemented.
EnMS documents are stored, updated and used in a manner that meets the requirements specified in subclause 4.5.4.2 bullets (a)–(g).	EnMS documents described in the previous section are maintained and controlled as per the procedure (above). – Random inspection by an auditor finds EnMS documents are in accordance with the procedure (above). – If controlled documents are used by the organization, an auditor can find copies at their specified location.

FAQs

Question 18-8: Should documents always be available at the points of use?

Answer 18-8: Documents should be available at points of use, providing their presence does not hinder or diminish the ability to comply with health and safety legislation in the area.

4.5.5 Operational control

What does ISO 50001 say?

The first part of subclause 4.5.5 requires the organization to identify, plan and implement activities for the operations and maintenance of significant energy uses in a manner that is consistent with the organization's energy policy, objectives, targets and action plans.

In order to comply with the standard, it requires the organization to:

- establish criteria for the operation and maintenance activities of significant energy uses, where their absence could lead to a significant deviation from effective energy performance;
- operate and maintain the significant energy use in accordance with appropriate operational criteria;
- provide appropriate communication of the operational controls to all employees and contractors working on significant energy use.

What does ISO 50001 mean?

At the end of the energy planning process, a range of significant energy uses and variables that affect the energy performance of significant energy uses should have been identified. Some of these opportunities may be related to changes to machines, energy sources or working practices. However, some of the opportunities can be related to the way in which significant energy uses are operated and maintained (O&M). This is what subclause 4.5.5 is about.

The first part of subclause 4.5.5 requires the organization to operate and maintain significant energy uses such that the energy performance of its significant energy use is controlled and the impact of any deviation from energy performance is minimized.

This is achieved by identifying the relevant procedures and ways of working within the organization, reviewing ways to minimize and/or control the variables and then to incorporate the findings into the procedures and ways of working.

However, the standard does not specify how or what methods the organization should use to control its operations and maintenance. This is a choice the organization needs to make. Some organizations may

choose to achieve this via operating procedures. Others may choose 'on the job' training, coaching and mentoring with a sign-off at each stage of the process. Some may choose to do both.

One thing that every organization must do is communicate any new or revised O&M procedures to all relevant employees and contractors.

Subclause 4.5.5 gives the organization an option to choose whether emergencies, contingencies and business continuity issues are subject to the same operational and maintenance requirements.

Related term(s) and definition(s)

3.24 procedure
3.27 significant energy use

Related clause(s)

4.4.3 Energy review
4.5.2 Competence, training and awareness
4.5.3 Communication
4.6.1 Monitoring, measurement and analysis

Evidence

Evidence	**Tools and techniques**
Criteria for operational controls are available and are being followed.	There are many ways in which the organization can demonstrate conformity with operational controls. Some examples are through: – record of operating and control philosophy; – operating procedures and their revision; – work instructions; – colour coding local gauges (e.g. pressure or temperature gauges) with red, yellow and green to indicate status of 'in control' or 'out of control'. – using trend charts on important parameters such as 'temperature', 'right first time' and 'reject';

Evidence	Tools and techniques
	– using the operating guidelines from the original equipment manuals; – training records; – checklists or worksheets; – Shewhart control charts. The management representative and/or energy management team can describe to an auditor or show evidence of how they have used output from the energy planning process to establish operational criteria, and how they have incorporated them into daily use. Employees and/or contractors can show or describe to an auditor what operational controls have been established, and describe how such operational control is used and monitored.
Criteria for maintenance controls are available and incorporated into use.	There are many ways in which an organization can demonstrate conformity with maintenance controls. Some examples are through: – maintenance plans; – spares plans; – charts such as 'availability', 'unplanned downtime' and 'mean time to failure'; – maintenance activities that accord with or exceed the requirement stated in original equipment manual; – maintenance record for failure, e.g. root cause analysis, 5-why analysis or failure modes analysis. The management representative and/or energy management team can describe to an auditor or show evidence of how they have used output from the energy planning process to establish maintenance criteria, and how they have incorporated them into daily use. Employees and/or contractors can show or describe to an auditor what maintenance controls have been

Evidence	Tools and techniques
	established, and describe how an established maintenance control is used and monitored.
The approved criteria are communicated to relevant employees (internal and external resource), and are understood and used by employees.	Random interviews or observations by an auditor show that: – operators, technicians and relevant contractors are aware of the existence of the operational and maintenance controls described above. – employees can carry out the operations and maintenance according to the set criteria, etc. This can be determined via spot checks, training records, etc.

FAQs

Question 18-9: Why is the requirement for operational and maintenance controls repeated in ISO 9001, 14001 and 50001?

Answer 18-9: Sometimes the excitement of introducing new 'things' can overshadow the benefits that good operational and maintenance control can contribute to energy performance. The same applies to other improvement schemes such as those related to health and safety, quality, throughputs and environment.

Also, it is important to strike a balance between the demands of energy management with those of other management systems and to achieve a consistent approach to O&M activities between them all.

4.5.6 Design

What does ISO 50001 say?

Subclause 4.5.6 requires the organization to consider energy performance improvement opportunities and operational control when designing new

or when modifying and renovating the organization's facilities, equipment, systems and processes that can have a significant impact on its energy performance.

Where relevant, organizations are required to incorporate the energy improvement opportunities and operational controls into the design, and to keep records of the design activity.

What does ISO 50001 mean?

Subclause 4.5.6 is applicable to any project that may result in new, modified and renovated facilities, equipment, systems and processes that might have a significant impact on the energy performance of the organization (within the declared scope and boundaries). Note the inclusion of 'systems and processes'.

The requirement is that the impact upon energy performance must be evaluated. If that evaluation results in agreement that the impact is significant, and should therefore be taken into account, then this must be reflected in the relevant specification, design and procurement activities.

In any event, the evaluation process must be documented and available for inspection by an auditor.

Related term(s) and definition(s)

None

Related clause(s)

4.4.2 Legal requirements and other requirements
4.4.4 Energy baseline
4.4.5 Energy performance indicators
4.4.6 Energy objectives, energy targets and energy management action plans
4.5.7 Procurement of energy services, products, equipment and energy

Evidence

Evidence	Tools and techniques
The design activity has been recorded.	– Ensure that 'design for energy performance' is included on the agenda of meetings related to appropriate projects. – Reports from the contractors documenting design activity. – Reports from independent energy consultants assessing the energy performance of the project, and identifying opportunities to improve energy performance. – Ensure that product design documents, users' specification documents, engineering design documents, engineering drawings of proposed installation, environmental reviews of projects, etc., contain opportunities for energy performance improvement.
The impact of taking into account energy performance during the design phase of projects has been assessed.	– The EnMS management representative and/or energy management team are involved in project meetings, including design review meetings; evidence includes, e.g.: • Attendance lists; • Notes from the management representative or members of the energy management team who attended project and/or design meetings; – Independent energy performance review of proposals; – Ensure that design documents, users' specification documents, engineering design documents, engineering drawings of proposed installations, environmental reviews of projects, etc. contain a section related to energy performance and/or

Evidence	Tools and techniques
	operational control requirements.

FAQs

Question 18-10: Why should energy performance be considered during design?

Answer 18-10: When an organization designs new facilities, equipment, systems or processes, or modifies existing ones, the design is often influenced the most by the capital budget available to the business.

However, a life cycle analysis of the project often shows that the energy consumed during the entire operational life of a project is the largest component of the cost. Therefore it is most important to ensure that the opportunity to improve energy performance is evaluated and given serious consideration: which is what ISO 50001 requires.

Furthermore, at the design stage there is usually the largest choice of opportunities to improve energy performance, ones that can give the largest energy performance improvement and can generally be incorporated at a fractional increase in capital compared with that of attempting to achieve the same result later by means of modification or retrofitting.

Question 18-11: Is it sufficient to just install the most energy-efficient equipment in order to meet the requirements of this clause?

Answer 18-11: Installing the most energy-efficient equipment is clearly an important factor to improve energy performance. But to maximize the benefit of the energy-efficient equipment it is also important to pay attention to:

- the distribution of the energy to its intended use. For example the pipe work (e.g. bypass valves, three-port valves, distribution headers) and ancillary systems (e.g. pumps, drives, control and instruments), are efficient.
- the installation, commissioning and O&M of equipment is as per the design intent.

All three aspects must be present to maximize the opportunity to improve energy performance. Coupling the most energy-efficient equipment with poorly designed pipe work could completely negate the benefits.

Question 18-12: Would installing the most energy-efficient equipment generate the greatest cost savings?

Answer 18-12: Theoretically, having the most energy-efficient system would mean having the greatest cost savings. This is mostly true for energy use using the same energy source.

However, an area to watch out for is when saving energy from one source of energy results in an increase in the consumption of another source of energy. A switch from one source of energy to another may result in an overall reduction in energy consumption, or in environmental benefits, but an increase in the overall monetary cost to an organization.

Question 18-13: What if the cost of the energy performance opportunity is too great for the business?

Answer 18-13: It depends what you mean by 'cost'. Sometimes, an organization has to weigh up its ability to purchase (modify or renovate) equipment against the availability of capital. It may be that this evaluation shows that capital expenditure (CAPEX) is not possible. However, ISO 50001 makes it clear that CAPEX on equipment is not the only way to improve energy performance.

Almost always, there are other means to improve energy performance. These could arise from:

- better operational control;
- better maintenance plans;
- matching the plant and machinery to the actual demands of the organization;
- applying good insulation techniques;
- minimizing idle time;
- minimizing waste.

Many of these opportunities can be identified and planned in right from the beginning of a project with no need for CAPEX.

4.5.7 Procurement of energy services, products, equipment and energy

What does ISO 50001 say?

When procuring energy services, products and equipment related to significant energy use, the standard requires the organization to:

- define and document purchasing specifications.

- establish and implement the criteria for assessing energy performance over the planned or expected operating lifetime.
- inform suppliers that procurement is based partly on energy performance.

What does ISO 50001 mean?

Subclause 4.5.7 informs the organization that in order to conform to the standard, it is required to control the procurement of products, equipment and services that are related to significant energy use. This is to ensure that procurement plays its part in improving energy performance as set out in the organization's energy policy.

ISO 50001 also informs the organization that to conform with the clause, it should:

- develop a purchasing specification for the procurement of energy services, products and equipment that have, or can have, an impact on significant energy use (as defined in the energy policy). It is worth remembering that some of the parameters that might be usefully incorporated into such a procurement specification may have been identified during the energy planning process.
- inform suppliers that decisions on the procurement of energy services, products and equipment related to significant energy use will be partly assessed based on the ability to improve energy performance.
- develop and agree on the method and criteria to be used when assessing the energy performance of the intended procurement over its planned or expected lifetime.
- assess any applicable quotations and proposals based on the agreed method and criteria above.

Related term(s) and definition(s)

3.16 energy services

Related clause(s)

4.3 Energy policy
4.4.6 Energy objectives, energy targets and energy management action plans
4.5.5 Operational control
4.5.6 Design

Evidence

Evidence	Tools and techniques
A specification for the procurement of energy services, products and equipment that have, or can have, an impact on significant energy use has been produced.	The procurement specification could be located in the following documents: – Design specification; – Users' specification; – Engineering design document; – Specification written by an external consultant; – Quotation from a supplier.
There is a statement to a supplier that procurement of energy services, products and equipment is evaluated partly on the basis of energy performance.	– Ensure that procurement and/or tender documents have a statement that procurement will be partly based on energy performance. – Ensure that the importance of energy performance is included on the agenda of meetings with potential suppliers, and that the minutes of such meetings record this.
The criteria and method for assessing energy performance over an expected operating lifetime have been established.	Criteria for carrying out assessment over the lifetime of a purchase are available for inspection by an auditor. These could be in a: – statement in the energy policy; – statement in other EnMS documentation; – appropriate policy or procedure. The criteria may contain information on what items classed under 'significant energy use' will be subject to assessment over their life cycle. It could mean that replacements and new purchases are subject to the analysis. Small parts and consumables are not normally included. Other information that could usefully be included in the criteria are: – definitions of planned lifetime, e.g. buildings 15 years, boilers 7 years, etc.; – discount factors to use; – or the location of up-to-date discount factors for the analysis, etc.

Evidence	Tools and techniques
	The analysis could be by means of: – simple payback; – discounted cash flow; – return on investment; – net present value; – internal rate of return; – life-cycle analysis; – cradle-to-cradle analysis. EnMS management representative, energy management team or other appropriately authorized personnel can describe to an auditor how they have carried out an energy performance assessment over the supposed lifetime of the energy services, products or equipment in question, or can show an auditor records from previous assessments.
That applicable assessments have been carried out.	Documentation to show that assessment to the chosen method and criteria (above) has been carried out.

FAQs

Question 18-14: What are energy services?

Answer 18-14: ISO 50001 defines energy services as 'activities and their results related to the provision and/or use of energy'. In relation to subclause 4.5.7, energy services might include:

- services such as the use of contractors for O&M;
- contracts to carry out the repair or servicing of equipment;
- contracts with Energy Service Companies (ESCO).

Question 18-15: Is it mandatory to specify and procure the most energy-efficient products and equipment?

Answer 18-15: ISO 50001 requires the organization to consider energy performance improvement opportunities as part of their procurement processes. It does not say that the organization must purchase the products with the best energy performance.

Some of the common reasons an organization might not choose to procure products with the greatest energy performance improvement opportunities are:

- The existing distribution network is very efficient. The contribution of the best energy-performing equipment does not generate additional benefits.
- The capital cost of the best energy-performing equipment is significantly more than the alternatives and is beyond the financial capability of the organization.

Some organizations carry out incremental benefit analysis to determine the best option for the organization.

Question 18-16: Is assessing procurement over an expected operating lifetime the same as life-cycle analysis?

Answer 18-16: In relation to procurement, it is up to the organization to '... establish and implement the criteria for assessing energy use, consumption and efficiency over the planned or expected operating lifetime...'. There are some well recognized methods for carrying out any cost–benefit analysis as part of decision making. These include a financial analysis using simple payback, net present value, internal rate of return or return on investment techniques. The specific criteria used for carrying out such financial analyses often depend on the financial and accounting policies of the organization: for example credit structure, debt structure and depreciation of capital assets.

In the absence of any specific guidelines from the organization (please do check with the appropriate staff), the following depreciation periods are a good start:

- Computers: 3–5 years;
- Buildings (freehold): 25–50 years;
- Buildings (leasehold): term of the lease up to 50 years (max);
- Production equipment: 10–25 years;
- Small energy use equipment such as pumps, and motors: 3–5 years;
- Utility plant: 10–25 years.

Where the organization wants to carry out a discounted cash flow analysis, then in the absence of any other specific advice, as a general guideline, the interbank lending rate is a good discount factor.

Large CAPEX procurements are often managed by an external service provider. If this is the case, then remember to include the requirements of ISO 50001 in the contract with the external service provider. Similarly, it is acceptable for the ISO 50001 elements of any procurement to be carried out by a suitable briefed and qualified external resource.

Finally what about life cycle assessment (LCA)? EN ISO 14040:2006, *Environmental management – Life cycle assessment – Principles and framework,* 3.2 defines an LCA as the 'compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle'. It seems to us, therefore, that an LCA is an acceptable form of evaluation. The key thing to remember is that you must be able to explain to an auditor what evaluation method has been chosen, and what criteria are used by the chosen method.

Chapter 19 – 4.6 Checking

Chapter 19 covers all of the 'check' and 'act' requirements of ISO 50001. In subclause 4.6, there is only one subclause (4.6.1) that contains technical-based requirements. All the other subclauses are management-systems-based requirements.

Subclauses 4.6.1 to 4.6.3 are centred around two themes: (1) ensuring the organization has carried out activities as planned during the planning phases; (2) that the activities planned are effective and improve the organization's energy performance.

If the planning and subsequent activities conform to the requirements of ISO 50001, then the organization will be able continually execute the energy management system (EnMS) as planned. However, if the plan or activities are falling short, subclauses 4.6.4 and 4.6.5 specify the requirements to correct errors and nonconformities in order to bring the EnMS back to plan. Chapter 4 is devoted to the topic of conformity assessment. If you have not already read Chapter 4, then we recommend that you take a look now.

4.6.1 Monitoring, measurement and analysis

Subclause 4.6.1 is explained over three parts:

1. Paragraphs (1) and (2);
2. Paragraphs (3) and (4);
3. Paragraphs (5) and (6).

In general, subclause 4.6.1 requires an organization to monitor, measure and analyse energy performance. It requires the organization to have an energy measurement and monitoring regime in place which is accurate and representative. Then it requires the organization to use energy monitoring and measurement analysis to validate, correct and/or improve its energy planning process.

Note In reality it is difficult to see how the energy planning processes described in Chapter 17 could have been carried out, or the efficacy of operational control checked, without having already defined and implemented the measurement plan required by the later subclause 4.6.1 explained here in Chapter 19.

Subclause 4.6.1, paragraphs (1) and (2)

What does ISO 50001 say?

Paragraphs (1) and (2) of subclause 4.6.1 requires the organization to, at planned intervals, measure, analyse and monitor key characteristics that affect the energy performance of significant energy use.

As a minimum, the key characteristics are:

- significant energy uses and other outputs of the energy review;
- variables related to significant energy uses;
- energy performance indicators (EnPIs);
- effectiveness of the action plans in achieving objectives and targets;
- evaluation of actual versus expected energy consumption.

The subclause also requires the organization to keep records of the results of monitoring and measurement.

What does ISO 50001 mean?

The first part of subclause 4.6.1 requires the organization to measure, analyse and monitor the key characteristics that are used to determine the energy performance of significant energy use, and do so at defined intervals. As a minimum, these include bullet points (a)–(e) of the subclause. The bullet points are not new requirements; the items have been identified, developed and agreed. None of the 'key characterisitics' to be measured, analysed and monitored should come as a surprise. They have all been covered in the clauses related to energy policy, energy planning, and implementation and operation. So if you get this far with your implementation and find that you cannot list the key characteristics, then you probably need to revisit these previous clauses.

As discussed at the beginning of this chapter, a good checklist would be to ask these questions:

- Has all of the significant energy use been identified?
- Are the EnPIs appropriate to the significant energy use?
- Are the variables that are used to explain the energy performance the most appropriate and are they correct?
- Is the energy baseline in a quantitative form and is it a good basis for comparing energy performance?
- Are operational and maintenance controls effective to minimize variations in energy performance?
- Are opportunities to improve energy performance properly recorded and is there a good level of confidence that they will be effective?
- Are the action plans producing the improvement in energy performance that had been planned?

If analysis shows that there is a good correlation between the quantum of energy consumed and the variables used to inform that analysis, then this reinforces that the energy baselines and EnPIs are appropriate for the organization.

Similarly, if an analysis shows energy performance improvement as predicted in action plans, it reinforces that the operational controls and action plans are delivering the intended benefits. Therefore, the organization can continue to carry out action plans with a good degree of confidence that they will be successful.

Related term(s) and definition(s)

3.12 energy performance

Related clause(s)

4.4.3 Energy review
4.4.4 Energy baseline
4.4.5 Energy performance indicators
4.4.6 Energy objectives, energy targets and energy management action plans
4.5.5 Operational control
4.5.7 Procurement of energy services, products, equipment and energy

Evidence

Evidence	**Tools and techniques**
Meaning of planned interval is defined.	– The management representative and/or energy management team can tell an auditor when the next review date is or describe how frequently measurement, analysis and monitoring is to be carried out. – The date for the next measurement, analysis and monitoring is recorded in the previous analysis. – The date is documented in the EnMS. – The date is planned throughout the year. – The minutes of meetings related to energy review, management review, etc. contains dates or the frequency

Evidence	Tools and techniques
	of monitoring.
Measurement, analysis and monitoring records are available.	– Records of measurement, analysis and monitoring are available for inspection by an auditor. Some examples are: • Analysis of energy consumption trends; • Boiler or chiller efficiency report by service contractor; • Comparison of actual energy consumed versus expected or budgeted energy consumption; • Monitoring and trending of key temperature, pressure, flow or electricity gauges is within control and as planned in operational controls (see Chapter 18, in the section on Clause 4.5.5); • Comparison of actual energy consumption versus expected energy consumption; • Analysis of key variables for projects to improve energy performance gave the expected energy performance improvements. – Dates of the records are in line with the dates or frequency of review as planned.

FAQs

Question 19-1: Can you give examples of things to be measured for a manufacturing plant?

Answer 19-1: Some examples relevant to a manufacturing environment are as follows:

– Composite EnPI, such as boiler efficiency or chiller coefficient of performance (COP), measured as part of the annual or six-monthly equipment servicing;

- Analysis of energy consumption for office is separated from analyses of manufacturing;
- Analysis of energy consumption for manufacturing as a whole compared with the identified energy variable (e.g. throughputs, quality, etc.) or expected energy consumption;
- Separate analysis of energy consumption based on individual manufacturing equipment, separate products, different energy source or separate utilities, compared with the identified energy variable (e.g. throughputs, quality, etc.) or compared with the expected energy consumption.

Question 19-2: Can you give examples of things to be measured for a commercial building?

Answer 19-2: Some examples relevant to a commercial building are as follows:

- Composite EnPI, such as boiler efficiency or chiller COP, measured as part of the annual or six-monthly equipment servicing;
- Analysis of energy consumption for the whole building compared with the identified energy variable (e.g. ambient temperature, occupancy, etc.) or expected energy consumption;
- Separate analysis of energy consumption based on different zones of the building or separate energy sources to the identified energy variable (e.g. ambient temperature, occupancy, etc.) or expected energy consumption.

Question 19-3: How much should I spend/budget for in order to measure energy performance improvement?

Answer 19-3: This is a question that an organization should always keep in mind when budgeting for the measurement and verification of energy performance improvements. If left unmonitored and uncontrolled, the cost of verifying energy performance improvement could spiral to more than 10 times the value of the energy performance improvement.

Bear in mind that if the cost to measure and verify energy performance is the same as the value of the energy performance improvement, then the return on investment is halved and the payback time doubled!

There is no fixed rule on how to budget for verifying energy performance: it depends on the accuracy the organization wants to achieve, and the time and data available for analysis. The organization should choose a method that represents a good balance between the value of the performance improvement and the financial resources available.

Question 19-4: How can an energy behaviour campaign and energy training be quantified?

Answer 19-4: The benefit of an energy behaviour campaign can be measured using techniques such as cumulative sum (CUSUM) analysis plotted on a CUSUM control chart. Impacts of an energy behaviour campaign, if it is successful, will cause a change in the slope of a CUSUM chart, beginning from the date when the campaign began.

The benefits of energy training and behaviour change can also be quantified by non-monetary outcomes from the training, such as commitment to 'energy charters' during training, or agreement to carry out specific tasks related to energy improvement.

Subclause 4.6.1, paragraphs (3) and (4)

What does ISO 50001 say?

Paragraphs (3) and (4) of subclause 4.6.1 require an organization to define, implement and periodically review an energy measurement plan for its monitoring and measurement needs.

The subclause also requires the organization to ensure that equipment used in the monitoring and measurement of key characteristics provides data which are accurate and repeatable.

What does ISO 50001 mean?

This part of subclause 4.6.1 requires the organization to develop a plan to measure key characteristics, as previously defined, in order to provide the data necessary for quantifying the energy performance of significant energy use.

This ensures that the organization is able to use data to measure, to learn and understand the characteristics of significant energy use, to use the measured data to assess energy performance, and to apply corrective and preventive actions as necessary to improve and sustain energy performance.

Please remember that this 'measurement plan' must also set out how all instruments used to measure energy and quantify energy performance are to be kept accurate and how accurate measurements can be repeatable. If there is a need for calibration, records of the calibration should be kept. Please note that this does not mean that the organization should purchase and install energy meters everywhere within the organization. This is a general misconception. While having metered information is easy, energy information could also be calculated by means of, for example, portable meters, local temperature and flow gauges, spot measurements and timed trials.

Related term(s) and definition(s)

None

Related clause(s)

None

Evidence

Evidence	Tools and techniques
An energy measurement plan is available and up to date.	– Ensure that the management representative and/or energy management team can show an auditor an energy measurement plan. Some examples are: • Energy flow chart showing incoming energy, how it is distributed and the location of key measurements; • Energy map; • Inventory of all available meters and how they relate to significant energy use. – Ensure that there is a date for future review of the energy measurement plan. This could be recorded in: • EnMS; • energy measurement plan; • minutes of meetings related to the energy planning process, management review, etc.
That measurements are made using instruments with known accuracy and repeatability. Details of the accuracy and repeatability of measurements are available.	– Ensure that instruments used to measure key characteristics are accurate and used properly to give confidence in a high degree of repeatability. Evidence includes: • User or manufacturer's manuals; • Use of operating procedures to ensure accuracy and repeatability; • Use of maintenance procedures

Evidence	Tools and techniques
	to ensure accuracy and repeatability; • Any recommendations contained in calibration certificates have been acted upon. Note Not all measurement instruments can be calibrated.
For instruments that should be calibrated, records of calibration are available.	Ensure that equipment used for measurement has the following: – Date of calibration; – Calibration certificate to show that it is calibrated to known standards; – Date of next calibration.

FAQs

Question 19-5: Does my organization have to install a lot of energy meters?

Answer 19-5: You need to have sufficient energy meters to be able to satisfy an auditor that you can measure your declared key characteristics accurately and in a repeatable fashion.

Some organizations install a lot of energy meters for every significant energy use. This exercise is very costly and generates a large quantity of data. Frequently, employees may not understand or look at the data these meters provide.

Data provided for measurement and analysis normally consists of two types:

- Information used for operational and maintenance control;
- Information used for reviewing, analysing and planning future actions.

Information used for operational and maintenance control should be in a form that is useful to anybody who uses it. The information should also be provided in a timely manner so that action can be taken to actively control energy performance. Remember that the key characteristics can involve the measurement of things such as of pressure, temperature or flow.

Information used for energy data analysis does not always have to be from energy meters. It could also come from the information used by the operators and maintenance technicians or from spot measurements. Sometimes it can be useful to combine the data from key characteristics into composite EnPI(s). This can be carried out manually, often by means of a spreadsheet, or it can automated.

Also, bear in mind that even if you can't immediately measure your declared key characteristics, you can always start to operate your EnMS using the data that you do have. Energy data can be built up in phases according to the organization's financial resources and capabilities. Just remember to make sure that your scope and boundaries reflect the data that you do have, or that you can explain any anomalies to an auditor.

Finally, we ask that you remember that the key success factor for effective measurement and verification is for those involved with the EnMS to understand the information that is available and to use the information to actively control and maintain energy performance. Without this, any amount of monitoring, measurement and analysis will not bring about an improvement in energy performance.

Subclause 4.6.1, paragraphs (5) and (6)

What does ISO 50001 say?

The final part of subclause 4.6.1 requires the organization to investigate, respond to and record significant deviations in energy performance.

What does ISO 50001 mean?

In order to comply with ISO 50001, the final part of subclause 4.6.1 requires an organization to investigate and take appropriate corrective and preventive action for any significant deviations in energy performance.

This is one of the most important parts of ISO 50001 and indeed of any management systems standard. The reason(s) for nonconformity (see Chapter 4) must be established and appropriate action taken. As we have said previously, the PDCA cycle is an excellent tool for doing this. By taking appropriate corrective action, and by incorporating lessons learned into the EnMS, so an organization embarks on continual improvement.

Related term(s) and definition(s)

3.2 continual improvement
3.3 correction

3.4 corrective action
3.12 energy performance
3.13 energy performance indicator (EnPI)
3.21 nonconformity
3.23 preventive action

Related clause(s)

4.4.3 Energy review
4.4.4 Energy baseline
4.4.5 Energy performance indicators
4.4.6 Energy objectives, energy targets and energy management action plans
4.5.5 Operational control
4.5.7 Procurement of energy services, products, equipment and energy
4.6.5 Control of records

Evidence

Evidence	Tools and techniques
The meaning of 'significant deviation in energy performance' is defined.	– The management representative and/or energy management team can describe to an auditor what constitutes a significant deviation. – Alternatively, the definition could be documented in the: • EnMS; • energy measurement plan.
The reasons for significant deviation(s) are investigated and understood.	Ensure that a root cause analysis of significant deviations has been carried out and can be shown to an auditor. Some examples of analysis are: – Review the list of significant energy use to ensure that all significant energy use has been captured. – Carry out a '5 why' analysis to determine whether there are other variables that affect the energy performance of significant energy use. Compare 5-why analysis findings with the existing EnPIs. – Check that operational and

Evidence	Tools and techniques
	maintenance controls have been implemented.
Where appropriate, corrective and preventive action has been applied.	There are many types of corrective and preventive action. Some examples are: – Review to confirm that all planned activities have been carried out; – Review of the energy planning process to incorporate new learning; – Change operating and maintenance requirements; – Engagement of consultants and/or supplier to investigate the issue. Corrective and preventive actions could be recorded in: – records of investigations; – records of internal audits; – production or maintenance logs; – minutes of relevant meetings.
Results of the investigation have been recorded.	The results could be recorded in: – records of investigations; – records of internal audits; – production or maintenance logs; – minutes of relevant meetings.

FAQs

Question 19-6: What constitutes a significant deviation?

Answer 19-6: There is no definition of what constitutes a significant deviation of energy performance. It is up to each organization to determine what the definition of significant deviation is.

Some examples are:

- The colour code used on local gauges is red when it should be green.
- The cost of the observed deviation is more than, say, 5 per cent of the energy cost to operate the significant energy use.
- Energy performance has deviated by, say, 10 per cent above the control limit.

4.6.2 Evaluation of compliance with legal requirements and other requirements

What does ISO 50001 say?

Subclause 4.6.2 requires an organization to evaluate and record its continued compliance with legal requirements and other requirements at planned intervals.

What does ISO 50001 mean?

Subclause 4.6.2 requires an organization to routinely review that it continues to operate in accordance with the latest applicable legal requirements and other requirements.

Related term(s) and definition(s)

None

Related clause(s)

4.4.2 Legal requirements and other requirements
4.6.5 Control of records

Evidence

Evidence	Tools and techniques
'Planned interval' has been defined.	There are many ways to show that 'planned interval' is defined. Some examples are: – During re-iterations of the energy planning process; – Interval is defined in the EnMS, e.g. that a review is carried out annually or when a new regulation and other requirements have been introduced, etc.; – A process exists to check for changes when new and other requirements have been published;

Evidence	Tools and techniques
	– The documents containing legal and other requirements state the next review date.
That the assessment of legal and other requirements is fit for purpose.	– Regular reading of trade magazines relevant to the organization's business to identify new and upcoming regulations and standards. – Web searches to review for updates to legal and other requirements. – Spot checks to ensure that operational controls incorporating legal and other requirements have been followed.
There are records of the assessment, if applicable.	Example of records could be found in: – internal audits; – review of procedures; – review of operating and maintenance controls; – purposely commissioned reports covering the conformity of legal and other requirements.

FAQs

None

4.6.3 Internal audit of the EnMS

What does ISO 50001 say?

Subclause 4.6.3 requires the organization to carry out and record internal audits at planned intervals to ensure that:

- the EnMS conforms to ISO 50001.
- the organization carries out planned activities as necessary to improve the EnMS.
- the planned activities are effective in improving the EnMS's ability to improve energy performance.

The subclause also requires the organization to prepare an audit plan and audit schedule for the EnMS and to select internal auditors in a manner to ensure the objectivity and impartiality of the audit process.

What does ISO 50001 mean?

Subclause 4.6.3 requires an organization to carry out internal audits of the EnMS at planned intervals. The purpose of an internal audit is to ensure that the EnMS:

- conforms to planned arrangements for energy management including the requirements of ISO 50001;
- conforms to the energy objectives and targets established by the organization;
- is effectively implemented and maintained, and that it improves energy performance.

In order to ensure objective and impartial assessment, the clause also requires an organization to create an audit plan and audit schedule, and to select auditors in such a way as to ensure that the internal audit is carried out in an objective and impartial manner. The results of internal audits are to be recorded and reported to top management.

Related term(s) and definition(s)

3.2 continual improvement
3.3 correction
3.4 corrective action
3.12 energy performance
3.13 energy performance indicator (EnPI)
3.21 nonconformity
3.20 internal audit
3.23 preventive action

Related clause(s)

All

Evidence

Evidence	Tools and techniques
An audit plan and schedule are defined and available.	An audit plan and schedule are available for review by an auditor, covering the following: – Organization has prioritized a series of clauses and/or areas within the organization for internal audit; – A procedure for internal audit is available; – The audit scope and audit areas have been defined; – The audit schedule (as appropriate to the size and complexity of the EnMS) covers all aspects of EnMS. Areas of significant energy use that can lead to significant nonconformity are audited more frequently: – If appropriate, ensure that you can describe which areas are audited more frequently, e.g.: • Areas of significant energy use; • Areas where there have been recent nonconformities; • Areas where there have been significant differences between estimated and actual energy performance; • Areas where previous preventative or corrective actions have been taken. – There are records of risk analysis of areas where significant deviation could result.
The auditor chosen to carry out an internal audit is objective and impartial.	It is possible to demonstrate that the auditor allocated for each audit (above) is objective and independent. This is particularly important in respect of internal auditors. In these circumstances, you can take the actions set out below. – Internal auditor is from a different department. – Internal auditor is from a different

Evidence	Tools and techniques
	site of the same company. – Internal auditor chosen can act in a manner that means the auditor looks for facts rather than for opinions and judgements of others and being influenced by peer pressure.
Records of internal audits are available.	– Audit report is up to date according to audit plan or schedule (above). – Copies of previous internal audits are available for inspection by an auditor.
Results of internal audits are reported to top management.	– Inputs to management review contain information from the internal audit. – Top management attends internal audit meetings.

FAQs

Question 19-7: Which ISO 50001 elements need to be audited more frequently?

Answer 19-7: The internal audit does not specify what elements within the organization are a priority. The organization needs to define the areas for internal audits, their frequency, and appoint internal auditors, based on the organization's needs, priorities and the potential for deviation in energy performance and for nonconformities.

Question 19-8: Can I use my organization's existing internal audit procedures from ISO 9001 or ISO 14001?

Answer 19-8: If an organization has a management system based on and fully conforming to ISO 9001 or ISO 14001, it is recommended that these are integrated as much as possible with other MSSs such as ISO 50001. This includes the requirements for internal audits.

If you choose to do this, then it is important to ensure that all requirements for ISO 50001 are contained in the existing procedure.

Question 19-9: Do people assigned responsibilities to carry out internal audits need to be specially qualified or trained?

Answer 19-9: There is no requirement in ISO 50001 for internal auditors to be specially qualified or trained; although bear in mind the general requirements set out in subclause 4.5.2 'Competence, training and awareness'. There is, of course, a requirement to demonstrate that internal auditors carry out their work in an objective and impartial way.

Useful guidance on auditing is contained in ISO 19011:2011, *Guidance for auditing management systems.* However, again there is no requirement that internal auditors have been trained in the use of ISO 19011.

Question 19-10: How do I ensure objectivity and impartiality using people within the organization?

Answer 19-10: 'Objective and impartial' does not mean 'independent'. An employee within the organization can always act objectively and impartially during an internal audit.

As far as possible, choose internal auditors who are not managed by the same manager as that of the area being audited, and ensure that the audit findings and conclusions are based purely on audit evidence.

4.6.4 Nonconformities, correction, corrective action and preventive action

What does ISO 50001 say?

Subclause 4.6.4 requires the organization to address actual and potential nonconformities. Some of the activities required to fulfil this requirement are:

- Identify actual or potential nonconformities.
- Determine the causes of nonconformities.
- Evaluate the need for corrective action. If necessary implement the corrective action.
- Maintain records of corrections applied.
- Review the effectiveness of the action taken.

What does ISO 50001 mean?

Subclauses 4.6.1 to 4.6.3 detail the things that must be 'checked' in order to identity situations where a requirement has not been fulfilled: i.e., where there are nonconformities. Subclause 4.6.4 requires an organization to identify the nonconformity and to assess the significance of the nonconformity in terms of its potential to cause significant deviation in energy performance and/or the EnMS.

The subclause then requires the organization to make a judgement about whether there is a need for corrective or preventive action. If so, then take the necessary actions, and to assess the effectiveness of the preventive action or correction.

Related term(s) and definition(s)

3.4 corrective action
3.21 nonconformity
3.23 preventive action

Related clause(s)

4 Energy management system requirements

Evidence

Evidence	Tools and techniques
The organization has identified, reviewed and investigated all actual and potential nonconformities and made a judgement about whether the nonconformities require corrective action, preventive action or both.	– Ensure that examples of review are available, such as: • The management representative and/or energy management team can show a list of identified nonconformities to an auditor and justify why a certain nonconformity is not investigated, etc. • Root cause analysis, 5-why analysis, failure mode and effect analysis, etc. show that the nonconformity is not significant in terms of its ability to affect energy performance and/or the EnMS. – The decision to apply corrective and/or preventive actions could be recorded in: • Minutes from EnMS meetings, internal audit finding meetings or management reviews; • Records contained in internal audit reports.

Evidence	Tools and techniques
If necessary, corrective action and preventive action have been applied.	Examples of corrective or preventive action may include: – New learning has been used to revise the content of the energy planning process; – Procedures have been revised; – Additional training has been provided; – Faulty equipment has been repaired to the equipment manufacturer's standards; – A plant expansion programme has been postponed by one month to review and incorporate features to improve energy performance; – A named person has been taken through the disciplinary procedure.
The applied action is effective.	Corrective or preventive measures have been communicated to the relevant employees and external resources. No more similar incidents have occurred.

FAQs

Question 19-11: How do I determine whether a nonconformity is major or minor?

Answer 19-11: Often, in order to prioritize actions, organizations try to second-guess whether an auditor will deem an identified nonconformity a major or a minor nonconformity. An objective and impartial auditor takes many items of evidence and factual information into account when assessing nonconformity, and it can be dangerous to try to 'second guess' the final outcome.

For example, an auditor may find, based on the audit trail and on experience, that the cause of a nonconformity may be due to parts of the EnMS that are not always immediately obvious. The trick is simply to focus on complying with all the requirements of ISO 50001, because if an organization does this then nonconformities should be rare, easily identified and easily put right.

Question 19-12: Does the organization need to investigate every deviation in energy performance?

Answer 19-12: The clause does not require an organization to investigate every deviation in energy performance. The organization must investigate and respond to significant deviations in energy performance. We have given some advice on what constitutes significant deviation earlier in this chapter.

4.6.5 Control of records

What does ISO 50001 say?

Subclause 4.6.5 requires an organization to define and implement controls for the identification, retrieval and retention of records both to demonstrate conformity with its EnMS and ISO 50001, and to show that the planned energy performance has been achieved.

The records shall be:

- legible;
- identifiable;
- traceable to the relevant activity.

What does ISO 50001 mean?

Subclause 4.6.5 refers solely to 'records'; remember that there is a difference between 'documents' and 'records'. Every record will be some form of document or other, but not every document will be a record. Chapter 7 gives extensive guidance on this: you are encouraged to read it.

A summary is that a record is a 'document stating results achieved or providing evidence of activities performed'. Records are normally archived so that they can be retrieved in the future. For this archival to be effective, there needs to be a means to identify and retrieve records and they need to be kept in a way that keeps them legible over time.

These are the basic requirements of subclause 4.6.5.

The organization may also choose to keep additional supporting records to demonstrate conformity with the standard.

Related term(s) and definitions(s)

3.24 procedure
3.25 record

Related clause(s)

4.5.4.1 Documentation requirements
4.5.4.2 Control of documents

Evidence

Evidence	Tools and techniques
The organization has defined and implemented a system to identify and retrieve records.	This could be by means of: – Procedure to control records (this could be the same procedure as that used for document control); – The management representative and/or energy management team can describe and show the procedures within the organization with regards to the control of records; – Procedure, statement or flow chart in the EnMS showing how records are kept.
Records are kept in a legible, identifiable and traceable manner.	Ensure that a representative sampling of records by an auditor shows that the records are retrievable, legible, identifiable and traceable.

FAQs

Question 19-13: Can my organization use the control of documents to meet the requirements of this clause?

Answer 19-13: Yes.

Question 19-14: What records are relevant?

Answer 19-14: It is mandatory for an organization to keep records as set out by the subclause: 'The organization shall establish and maintain

records, as necessary, to demonstrate conformity to the requirements of its EnMS and of this International Standard, and the energy performance results achieved.' But what does 'necessary' mean? A good starting point is to refer to the minimum set of documents that ISO 50001 requires; but remember that not every document becomes a record.

Chapter 7 gives detailed advice on every mention of 'document' in ISO 50001. For convenience a summary is also provided in the following table.

Table 17 – References to 'document' in ISO 50001

3.20	Documented internal audit
4.2.2(e)	Framework for setting and reviewing energy objectives and targets
4.2.2(g)	Criteria and methods needed to ensure that both the operation and control of EnMS are effective
4.4.1	Energy planning process
4.4.2	Identify and have access to legal requirements and other requirements;
4.4.2	Determine how these requirements apply to the organization's energy use
4.4.3	Methodology and criteria used to develop energy review
4.4.3	Energy review
4.4.3	Criteria to prioritize opportunities for improving energy performance
4.4.4	Establish an energy baseline
4.4.5	Identify EnPI
4.4.5	Methodology for determining and updating EnPI
4.4.6	Energy objectives and targets at the relevant functions, levels, processes or facilities
4.4.6	Action plans for achieving the organization's objectives and targets

4.5.2	Person(s) working for or on its behalf, related to significant energy uses, are competent on the basis of appropriate education, training, skills or experience
4.5.2	Identify training needs associated with the control of the organization's significant energy uses
4.5.2	The organization shall ensure that any person(s) working for or on its behalf are aware of ...
4.5.3	Establish and implement a process by which any person working for or on behalf of the organization can make comments or suggest improvements to the EnMS
4.5.3	Decide whether to communicate externally about the organization's energy policy, EnMS and energy performance
4.5.3	Establish and implement a method for this external communication
4.5.4.2	Establish, implement and maintain procedure(s) to ...
4.5.5	Establish and set criteria for the effective operation and maintenance of significant energy uses
4.5.5	Appropriate communication of the operational controls
4.5.6	Consider energy performance improvement opportunities and operational control ...
4.5.6	Results of the design activity (design of new, modified and renovated facilities, equipment, systems and processes)
4.5.7	When procuring energy services, products and equipment that have, or can have, an impact on significant energy use, the organization shall inform suppliers that procurement is partly evaluated on the basis of energy performance
4.5.7	Establish and implement the criteria for assessing energy use, consumption and efficiency over the planned or expected operating lifetime;
4.5.7	Define and document energy purchasing specifications

4.6.1	The results from monitoring and measurement of the key characteristics shall be recorded
4.6.1	An energy measurement plan, ..., shall be defined and implemented
4.6.1	The organization shall define and periodically review its measurement needs
4.6.1	Records of calibration and other means of establishing accuracy and repeatability shall be maintained
4.6.1	The organization shall investigate and respond to significant deviation in energy performance;
4.6.2	Records of the results of the evaluation of compliance shall be maintained
4.6.3	An audit plan and schedule shall be developed
4.6.3	The selection of auditors ...
4.6.3	Records of the audit results shall be maintained and reported to top management
4.6.5	The organization shall define and implement controls for the identification, retrieval and retention of records
4.7.1	Records of management reviews shall be maintained
4.7.2	Inputs to the management review ...
4.7.3	Outputs from the management review ...

Chapter 20 – 4.7 Management review

Subclauses 4.7.1 to 4.7.3 are reviewed as a whole. This is because subclause 4.7.1 describes the requirement for a management review. It takes the inputs listed in subclause 4.7.2 and explains that the management review should contain the outputs listed in subclause 4.7.3.

4.7.1 General

What does ISO 50001 say?

Subclause 4.7.1 requires the top management to review and record the status of the organization's energy management system (EnMS) to ensure it continues to be suitable, adequate and effective.

What does ISO 50001 mean?

Subclause 4.7.1 is straightforward. It requires the top management of an organization to review, at planned intervals, the organization's EnMS. The review is required to ensure that the EnMS continues to be suitable, adequate and effective. The review is similar to the 'Quarterly Business Reviews' that some of our readers might be familiar with.

The inputs necessary for the management review are listed in subclause 4.7.2. The outputs from the management review are listed in subclause 4.7.3.

Related term(s) and definition(s)

3.22 organization
3.28 top management

Related clause(s)

4.7.2 Input to management review
4.7.3 Output from management review

Evidence

Evidence	Tools and techniques
There is a defined interval for management reviews.	– The schedule or plan for all management reviews is recorded in top management's calendar, agendas, or in the EnMS itself. – The date of the next management review is recorded in the minutes of every management review meeting.
A management review has been carried out by top management.	Ensure that top management or the management representative can show records of a management review of the EnMS, e.g. minutes of meetings, or transcripts of management reviews.
Inputs to management reviews contain information relating to bullet points (a)–(i) of subclause 4.7.2.	Ensure that records of inputs into a management review contain the information required by subclause 4.7.2, bullets (a)–(i). Examples of these records are: – Agendas for management review; – Copies of documents provided to the management review; – Minutes of management review meeting show discussion of inputs has taken place.
Outputs from the management review contain information relating to bullet points (a)–(e) of subclause 4.7.3.	Ensure that records of inputs into a management review contain the information required by subclause 4.7.2, bullets (a)–(i): – Copies of records provided from the management review contain all of the information covered. – Minutes of management review meetings, reports and/or transcript show that a discussion of inputs has

Evidence	Tools and techniques
	taken place.

FAQs

Question 20-1: Does 'management review' mean a meeting?

Answer 20-1: The subclause does not require a meeting to be carried out. Although a meeting is one of the means to carry out a management review, other means to meet the requirements of this clause are:

- Circulating the appropriate documents and records to top management, and collecting comments;
- Telephone and/or video conference;
- Web-based meetings;
- E-mail.

Question 20-2: Does top management have to prepare the inputs to the management review?

Answer 20-2: Subclause 4.7.1 does not specify who is responsible for preparing the necessary inputs to the management review. It is unlikely that top management would prepare the inputs. The task would normally be carried out by the management representative, energy management team, external consultants, etc.

Question 20-3: When is a suitable time to carry out the first management review?

Answer 20-3: There is no set recommendation on a suitable time to carry out a management review. This depends of the capability of the management representative and energy management team. Having said that, one commonly used time frame is one to two months after the first energy objective is achieved.

Appendix A – Terms and definitions in ISO 50001

The purpose of this appendix is to provide you with all of the terms and definitions contained in ISO 50001. Chapter 2 explains that understanding how ISO deals with terminology is very important. It doesn't matter what you think a word means, in the world of ISO if a word has been given a formal definition, then it becomes a 'term' and it is this that will be applied to any assessment of conformity with the requirements of ISO 50001.

Also, please remember the 'rule of substitution'. Chapter 10 includes a worked example of how important it can be to understand this, using the term 'energy performance' as an example.

Term (abbreviation)	**Definition**
3.1 boundaries	physical or site limits and/or organizational limits as defined by the organization EXAMPLE A process; a group of processes; a site; an entire organization; multiple sites under the control of an organization.
3.2 continual improvement	recurring process which results in enhancement of energy performance and the energy management system NOTE 1 The process of establishing objectives and finding opportunities for improvement is a continual process. NOTE 2 Continual improvement achieves improvements in overall energy performance, consistent with the organization's energy policy.

Term (abbreviation)	Definition
3.3 correction	action to eliminate a detected nonconformity (3.21)[11] NOTE Adapted from ISO 9000:2005, definition 3.6.6.
3.4 corrective action	action to eliminate the cause of a detected nonconformity (3.21) NOTE 1 There can be more than one cause for nonconformity. NOTE 2 Corrective action is taken to prevent recurrence whereas preventive action is taken to prevent occurrence. NOTE 3 Adapted from ISO 9000:2005, definition 3.6.5.
3.5 energy	electricity, fuels, steam, heat, compressed air, and other like media NOTE 1 For the purposes of this International Standard, energy refers to the various forms of energy, including renewable, which can be purchased, stored, treated, used in equipment or in a process, or recovered. NOTE 2 Energy can be defined as the capacity of a system to produce external activity or perform work.
3.6 energy baseline	quantitative reference(s) providing a basis for comparison of energy performance NOTE 1 An energy baseline reflects a specified period of time. NOTE 2 An energy baseline can be normalized using variables which affect energy use and/or consumption, e.g. production

[11] Clause numbers in parentheses indicate that the term immediately preceding is also defined in ISO 50001 under the clause referenced.

Term (abbreviation)	Definition
	level, degree days (outdoor temperature), etc. NOTE 3 The energy baseline is also used for calculation of energy savings, as a reference before and after implementation of energy performance improvement actions.
3.7 energy consumption	quantity of energy applied
3.8 energy efficiency	ratio or other quantitative relationship between an output of performance, service, goods or energy, and an input of energy EXAMPLE Conversion efficiency; energy required/energy used; output/input; theoretical energy used to operate/energy used to operate. NOTE Both input and output need to be clearly specified in quantity and quality, and be measurable.
3.9 energy management system (EnMS)	set of interrelated or interacting elements to establish an energy policy and energy objectives, and processes and procedures to achieve those objectives
3.10 energy management team	person(s) responsible for effective implementation of the energy management system activities and for delivering energy performance improvements NOTE The size and nature of the organization, and available resources, will determine the size of the team. The team may be one person, such as the management representative.

Term (abbreviation)	Definition
3.11 energy objective	specified outcome or achievement set to meet the organization's energy policy related to improved energy performance
3.12 energy performance	measurable results related to energy efficiency (3.8), energy use (3.18) and energy consumption (3.7) NOTE 1 In the context of energy management systems, results can be measured against the organization's energy policy, objectives, targets and other energy performance requirements. NOTE 2 Energy performance is one component of the performance of the energy management system.
3.13 energy performance indicator (EnPI)	quantitative value or measure of energy performance, as defined by the organization NOTE EnPIs could be expressed as a simple metric, ratio or a more complex model.
3.14 energy policy	statement by the organization of its overall intentions and direction of an organization related to its energy performance, as formally expressed by top management NOTE The energy policy provides a framework for action and for the setting of energy objectives and energy targets.
3.15 energy review	determination of the organization's energy performance based on data and other information, leading to

Term (abbreviation)	Definition
	identification of opportunities for improvement NOTE In other regional or national standards, concepts such as identification and review of energy aspects or energy profile are included in the concept of energy review.
3.16 energy services	activities and their results related to the provision and/or use of energy
3.17 energy target	detailed and quantifiable energy performance requirement, applicable to the organization or parts thereof, that arises from the energy objective and that needs to be set and met in order to achieve this objective
3.18 energy use	manner or kind of application of energy EXAMPLE Ventilation; lighting; heating; cooling; transportation; processes; production lines.
3.19 interested party	person or group concerned with, or affected by, the energy performance of the organization
3.20 internal audit	systematic, independent and documented process for obtaining evidence and evaluating it objectively in order to determine the extent to which requirements are fulfilled NOTE See Annex A for more information.
3.21 nonconformity	non-fulfilment of a requirement [ISO 9000:2005, definition 3.6.2]

Term (abbreviation)	Definition
3.22 organization	company, corporation, firm, enterprise, authority or institution, or part or combination thereof, whether incorporated or not, public or private, that has its own functions and administration and that has the authority to control its energy use and consumption NOTE An organization can be a person or a group of people.
3.23 preventive action	action to eliminate the cause of a potential nonconformity (3.21) NOTE 1 There can be more than one cause for a potential nonconformity. NOTE 2 Preventive action is taken to prevent occurrence, whereas corrective action is taken to prevent recurrence. NOTE 3 Adapted from ISO 9000:2005, definition 3.6.4.
3.24 procedure	specified way to carry out an activity or a process NOTE 1 Procedures can be documented or not. NOTE 2 When a procedure is documented, the term "written procedure" or "documented procedure" is frequently used. NOTE 3 Adapted from ISO 9000:2005, definition 3.4.5.
3.25 record	document stating results achieved or providing evidence of activities performed NOTE 1 Records can be used, for example, to document traceability and to provide evidence of verification, preventive action and corrective action.

Term (abbreviation)	Definition
	NOTE 2 Adapted from ISO 9000:2005, definition 3.7.6.
3.26 scope	extent of activities, facilities and decisions that the organization addresses through an EnMS, which can include several boundaries NOTE The scope can include energy related to transport.
3.27 significant energy use	energy use accounting for substantial energy consumption and/or offering considerable potential for energy performance improvement NOTE Significance criteria are determined by the organization.
3.28 top management	person or group of people who directs and controls an organization at the highest level NOTE 1 Top management controls the organization defined within the scope and boundaries of the energy management system. NOTE 2 Adapted from ISO 9000:2005, definition 3.2.7.

Appendix B – The meanings of common words used in management system standards

The purpose of this appendix is to give you some further advice on the use of terminology and ISO management system standards (MSSs). Chapter 2 explains that understanding how ISO deals with terminology is very important. It doesn't matter what you think a word means, in the world of ISO if a word has been given a formal definition, then it becomes a 'term' and it is this that will be applied to any assessment of conformity with the requirements of ISO 50001. This is why Appendix A lists all of the terms applicable to ISO 50001.

However, ISO has not provided definitions for words that are seen as being generally understood and common. The problem with this is that sometimes one reader's understanding of these common words is different from other readers'. During the development of ISO 9001 and ISO 9004 (two of the most widely used MSSs), great care was taken to use the 'correct' English words, so as to provide some consistent understanding of the concepts behind these common words.

Selected dictionary meanings of these common words were published and are freely available at http://isotc.iso.org/livelink/livelink/open/tc176SC2public. For your convenience, these dictionary meanings are repeated below, so that you can use them as appropriate.

Word		**Meaning**
accordance	noun	(in accordance with) in a manner conforming with
activity	noun	action in pursuit of an objective
adequacy	noun	sufficiency to satisfy a requirement
adjustment	noun	act of making something to match a standard

Word		Meaning
analysis	noun	detailed examination of the elements or structure of something
applicable	adjective	relevant
appropriate	adjective	suitable (for, to)
assess	verb	determine the value of
authority	noun	power to command or give a final decision; body that has legal powers and rights
available	adjective	able to be used or obtained
awareness	noun	knowledge or perception of a situation or fact
calibration	noun	act of aligning the accuracy of a measuring equipment to a known standard
commitment	noun	state of being dedicated to a cause or policy
communication	noun	action of sharing or exchanging information or ideas
complaint	noun	an expression of dissatisfaction, displeasure or discontent
comply	verb	(person or organization) meet specified standards
confirm	verb	support or establish the certainty or validity of
conform	verb	(item) meet specified requirements; to act in accordance with prevailing standards or customs

Word		Meaning
consistent	adjective	(consistent with) conforming to or in agreement with; coherent with
consistently	adverb	unchanging over time
control	noun	power to direct, restrain or regulate; means of restraining or regulating
control	verb	direct, restrain or regulate; restrain or regulate
data	noun	facts used for reference or analysis
define	verb	state or describe exactly the nature, scope or meaning of
demonstrate	verb	show clearly with objective evidence
deploy	verb	put into use or action
deployment	noun	implementation
determine	verb	establish or find out with certainty by research, examination or calculation
disposition	noun	action of dealing with things in a particular way
distribution	noun	act of allocating to recipients
documentation	noun	a set of documents, for example specifications and records, is frequently called 'documentation'
enhance	verb	improve the quality, value or extent of
ensure	verb	make certain of
essential	adjective	absolutely necessary

Word		Meaning
establish	verb	set up
evaluate	verb	synonym: assess
exclusion	noun	item or eventuality specifically not covered
expectation	noun	belief about (or mental picture of) the future; wishing with confidence of fulfilment
experience	noun	practical contact with and observation of facts and events
facilitate	verb	make easy or easier; promote, help forward (an action, result, etc.)
feedback	noun	information given in response to a product, a person's performance of a task, etc., used as a basis for improvement
focus	noun	centre of interest or activity
framework	noun	essential supporting or underlying structure
functional	adjective	designed to be practical and useful
hardware	noun	See the definition of 'product' in ISO 9000:2005 clause 3.4.2
identifiable	adjective	recognizable through a unique characteristic
identify	verb	establish the identity of someone or somebody
impartiality	noun	state of being without prejudice or bias
implement	verb	put into effect or practice

Word		Meaning
improvement	noun	action or process of making or becoming better
independent	adjective	not connected with another; separate; not subject to another's authority
integrity	noun	state of being whole; the condition of being unified or sound in construction
irrespective	adjective	in spite of; without regard to
justification	noun	evidence proving that something is right or reasonable
legible	adjective	possible to be read by a person or a machine for intended use
liaison	noun	communication or cooperation between people or organizations
maintain	verb	cause or enable (a condition or state of affairs) to continue
maintenance	noun	process or state of keeping (a system, service, building, machine, etc.) in good order by checking or repairing it regularly
measurable	adjective	able to be measured
measure	verb	ascertain size, amount, or performance of (something) by comparison with a standard unit or with an object of known size
methodology	noun	system of methods used in a particular field
monitor	verb	observe and check over a period of time; maintain regular close observation over

Word		Meaning
necessary	adjective	required to be done, achieved or present
need	noun	a lack of something that is required
objective	noun	something to be achieved
objective	adjective	not influenced by personal feelings or opinions in considering or representing facts
obsolete	adjective	no longer produced or used; out of date
origin	noun	point at which something begins or arises
outsource	verb	obtain goods or services from an outside supplier when considered as an alternative to carry out the associated process within the own organization
perception	noun	way of regarding, understanding or interpreting something
performance	noun	the ability to achieve something; the achievement itself
periodic	adjective	recurring or reappearing at regular intervals
physical	adjective	tangible or concrete
plan	noun	scheme, programme or method worked out beforehand for the accomplishment of an objective
plan	verb	decide on and arrange in advance

Word		Meaning
practicable	adjective	capable of being done with means at hand and circumstances as they are
preservation	noun	action or act of maintaining something in its original or existing state
previous	adjective	existing or occurring before something else in time or in order
process approach	noun	systematic identification and management of the processes employed within an organization and particularly the interactions between such processes
promote	verb	further the progress of, support or encourage
property	noun	thing or things belonging to a person, persons or organization
protect	verb	keep safe from damage
realization	noun	action of achieving something desired or anticipated; fulfilment
recognize	verb	be fully aware of; perceive or show acceptance of the validity or reality of something
regulatory	adjective	required, permitted or enacted by a rule or directive passed by an authority
relevant	adjective	closely connected or appropriate to the matter in hand
require	verb	express need essential to the fulfilment of something

Word		Meaning
resource	noun	stock or supply of materials, assets or personnel
responsibility	noun	task which a person or organization is required to do or control as part of a job, role or legal obligation
responsible	adjective	having an obligation to do something or having control over or care for someone
retain	verb	keep possession of; not abolish, discard or alter
retrievable	adjective	capable of being brought back
safeguard	verb	protect or prevent something undesirable (from happening)
scope	noun	extent of the area or subject matter that something deals with or to which it is relevant
sequence	noun	a particular order in which related events, movements, etc., follow each other
skill	noun	ability to do something well
software	noun	See definition of 'product' in ISO 9000:2005 clause 3.4.2
specific	adjective	of or relating to a particular subject
specify	verb	state explicitly, clearly and definitely
statutory	adjective	required, permitted or enacted by a written law passed by a body having the power to make laws [See also regulatory]

Word		Meaning
strategy	noun	systematic plan of action to achieve an aim
suitability	noun	characteristic of something that is right or appropriate for a particular purpose
suitable	adjective	appropriate (for a particular purpose)
supply	verb	make available for use
systematic	adjective	done or acting according to a system
training	noun	act of developing a particular skill or type of behaviour through demonstration, instruction and practice
unambiguous	adjective	having only one meaning
utilities	noun	services such as gas, water, electricity, telecommunication, etc.
validate	verb	carry out validation
validity	noun	conformity to fact, accuracy or precision
verify	verb	carry out verification
workspace	noun	area in which work is performed

Appendix C – Bibliography

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Implementing and Improving an Energy Management System

How to Meet the Requirements of ISO 50001

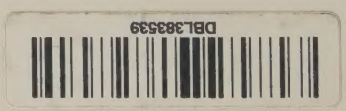
Effective energy management using ISO 50001 is good for business. It can help you to:

- measure and monitor energy use to identify where to improve efficiency
- improve overall performance to cut energy consumption and bills
- reduce carbon emissions and meet government reduction targets.

Implementing and Improving an Energy Management System is the practical companion to the international standard for energy management and provides a detailed, process-by-process guide to understanding and implementing all of its requirements.

Part A discusses ISO management system standards generally, putting ISO 50001 into context. It explains how to get the most benefit from its use, and shows the steps necessary for implementation based on the ISO 'process approach'. Part B tackles the core technical principles of energy management needed for successful use of the standard. It is aimed at those non-energy professionals who would welcome some technical help. Part C takes a clause-by-clause look at ISO 50001, providing detailed interpretation as well as practical guidance on complying with each of the requirements. Here you will find hints and tips on how to record and evidence your performance as well as answers to all of the most frequently asked questions.

So, whether you are an experienced energy manager looking for assistance setting up a formal management system for the first time, or an experienced management system professional with little energy experience, this essential guide to ISO 50001 is for you.



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